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ABSTRACT

This curriculum package was developed to be used as a guide for high school vocational agriculture teachers in Oregon preparing a curriculum to meet local community/regional needs. A second goal of this curriculum is to eliminate sex-bias or sex-role stereotyping in vocational agriculture classes. The curriculum contains 20 units. Topics covered in the units include an introduction to the vocational agriculture curriculum, including the problem of sex bias, and a four-year unit outline; orientation; tractor operation and safety; Future Farmers of America; small gasoline engine maintenance; beef breeds, selection, and management; supervised occupational experience programs; records; parliamentary procedure; sheep breeds, selection, and management; dairy, poultry, rabbits, horses, and goats; swine breeds, selection, and management; agricultural mechanization; plant science; ornamental horticulture; alfalfa production and hay quality testing; and livestock showing and fitting. Units contain a variety of materials, such as teaching suggestions, content outlines, student worksheets, suggested learning activities, and transparency masters. (KC)

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OREGON AGRICULTURE I CURRICULUM GUIDE

U. S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

EDUCATIONAL SERVICES DIVISION
WASHINGTON, D. C. 20540

S. J. Case

Introduction Preface

Oregon State University's Department of Agricultural Education directed the development of this curriculum package under a grant (50-004-313) from the Oregon Department of Education. The opinions expressed herein, however, do not necessarily reflect the position or policy of the Oregon Department of Education, and its endorsement should not be inferred.

Much of the materials used in the curriculum package were adopted from curriculum materials available in other states. We sincerely appreciate and acknowledge the contributions made by the following institutions to the Oregon curriculum guide:

1. Vocational Instructional Services, Texas A&M University.
2. Vocational Agriculture Services, University of Illinois.
3. Vocational Education Productions, California Polytechnic State University.
4. Oklahoma State Department of Vocational and Technical Education, Stillwater, Oklahoma.
5. Oregon State University Extension Materials, Oregon State University.

Gratitude is also expressed here to the members of this Curriculum Project Advisory Committee who advised on content, format and field tested the draft copy of the curriculum guide. Members are:

- | | |
|-------------------|----------------------------|
| 1. Dave Hall | Wallowa High School |
| 2. Dave Yost | Joseph High School |
| 3. Jerry Booth | Hillsboro High School |
| 4. Phil Ward | Central High School |
| 5. Jacque Deeds | Clatsop High School |
| 6. Preston Winn | Sherman County High School |
| 7. Mike Pratt | Bonanza High School |
| 8. Mel Thompson | Amity High School |
| 9. Ron McGee | Cascade High School |
| 10. Les Geren | Sandy High School |
| 11. Mike Williams | Gervais High School |
| 12. Kurt Spencer | Oakland High School |
| 13. Tom Wright | Madras High School |
| 14. Gary Sundseth | Crook County High School |
| 15. Scott VanNice | Weston-McEwen High School |

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Use of Curriculum Material

This curriculum package was developed to be used as a guide which vocational agriculture teachers could use in preparing curriculum which would meet local community/regional needs. The Vocational Agriculture Instructor should use a local Vocational Agriculture Advisory Committee to evaluate the appropriateness of this material to a given locale and eliminate that part of the material which was not appropriate while supplementing with material the advisory committee and instructor deemed appropriate to bring the curriculum package to completion for a specific program.

Remember that the goal of vocational agriculture was to place people in the agricultural occupations of their choice (which require less than a baccalaureate degree for entry, or further training for that occupation choice). The instructor helps students set realistic occupational goals in agriculture then, through advisory committee input, designs curriculum which would allow students to meet those goals.

Accountability of vocational programs has been and will continue to be measured by placement of students in appropriate occupations to the subject matter taught. An important criteria for success with regard to a placement standard would be student selection. The previous paragraph discussed helping students set realistic occupational goals. The occupational goals of the student and goals of the vocational agriculture program should be consistent with each other. If you need help with identifying appropriate student selection criteria refer to the "Policies and Procedures Handbook for Oregon Vocation Agriculture Programs by John Oades and Jacquelyn Deeds. Page 4 & 101 could be particularly useful to this discussion.

Eliminating Sex Bias in Vocational Agriculture Class

A second goal of this curriculum was to assure that there was no sex-bias or sex-role-stereotyping in vocational agriculture classes. The following article by Paula Diperna entitled "Up On The Farm" was included so that the Vocational Agriculture teacher may use it in attitude adjustment, and as a recruiting tool to encourage young women to enter agricultural occupations.

Every effort has been made to remove sex-bias from the curriculum material contained in this package. As the instructor develops material to supplement this curriculum in meeting local/regional needs they are encouraged to avoid sex-bias/sex-role-stereotyping.

Up On The Farm

by Paula Diperna

Most cityfolk tend to be naive about life down on the farm. They think of cows mooing, pigs oinking and chickens scratching around the barnyard. They also harbor images of farm women with their hair in buns, doing little more than churning butter and organizing quilting bees. However persistent these preconceptions are, reality simply does not bear them out. Agriculture is a complex and demanding science, offering a wide variety of career opportunities, and women are participating at every level in unprecedented numbers. Women now own farms, manage farms, loan money to farmers, promote farm products, write about farms, lobby farm issues, sell farm equipment and supplies, teach farming techniques, run farm machinery, plant, landscape, milk, work livestock and harvest crops. Female attendance at agricultural colleges has jumped radically, with some schools reporting 100 percent increase in just a few years' time. Today, women make up one-third of the undergraduate agricultural enrollment. The word is out--women on the farm are anything but down.

FEMALE FARM LABOR: THE BACKBONE OF AMERICAN AGRICULTURE

Women have been integral to the American agricultural process since the first seeds were sown in the new colonies. Farming then was a family proposition, and the farm woman usually was a wife who ran the household and pitched in with the chores--the stoic, hard-working, invariably dependable backbone of the family--farm unit. In fact, without female agri-labor, the rapid development of American agriculture never could have taken place.

It is interesting that women have always performed a wide variety of farm duties. Sherry Thomas, a former sheep rancher and coauthor of Country Woman: A Handbook for the New Farmer, is currently compiling an oral history by interviewing women who've been involved in agriculture for years. "I'm seeing that what is often regarded today as 'strange' behavior for women--like heavy farm work--has always been acceptable on the farm itself." Indeed, farm magazines in the less-than-liberated early 1900s ran numerous articles with titles such as "Beekeeping for Women"; "Three Women Who Make Mammoth Bronze Turkeys Pay Well"; "The Mistress of Overlook Farm." In 1907, a lengthy article in Farm and Fireside magazine explained: "Of late years, a constantly increasing number of women have graduated into the ranks of independent farmers, owning or leasing farms on their own responsibility and personally superintending every detail, from the purchase of the seeds to the marketing of the produce. The pioneers...are the widows of practical farmers [but they] have been joined in

many localities by other women who have migrated from cities and towns...simply because they were convinced that the work would prove more congenial than any of the other occupations open to women."

These words might just as well have been written today about the many women actively involved in farm production, who have to be part scientist, part business whiz, part magician--and plenty on the ball.

TODAY'S WOMEN FARMERS:
SHREWD AND PROFESSIONAL,
365 DAYS A YEAR

Kaye Fisher and Margaret (Maggie) Fessard, for example, run a 272-acre dairy farm in upstate New York with 100 head of registered Holstein cattle. The farmhouse is at least a century old, and the farm itself originally belonged to Fisher's grandfather. Fisher grew up on it and was right-hand helper until she went off to become a biology teacher. After two years in the classroom, she went back to take over the farm because she "just felt that was where I wanted to be." Fisher was not formally prepared for her new role. "There was a lot of things I'd never bothered to learn, or that my father hadn't bothered to teach me because nobody expected that eventually I'd be running the place." Fessard, also a teacher, and a city woman with absolutely no farming background, came down for a summer to visit and stayed on, learning by trial and error. Her initiation rite was to disc, or break up, a 40 acre pasture--a job considered to be one of a farmer's toughest on a tractor. She did it with no mishap. "I figured if I could do that, I could do anything," said Fessard.

Despite their lack of theoretical background, Fisher and Fessard have enjoyed considerable success. In the four and a half years they have run the farm, the milking herd has grown from 16 to 43 head. In addition, they breed cattle, board horses and grow all the feed -- except the protein supplements -- their animals consume. But admirer beware: They work extraordinarily hard.

The day, begun at 5:30 AM, 365 days a year, and ended at about 7 PM, is taken up with milking, feeding, barnyard and housekeeping, cropping, tending pasture, baling hay, etc., etc., etc. There is only one full-time worker--a male--though there are occasionally part-time workers.

The milking ritual is fascinating to watch. While Fessard cajoles the Holsteins back into the milking area from the outdoor pastures, Fisher settles them into their stalls. She barely can be seen amount the cows--their shoulders are about even with her shoulders. Clearly each animal has an individual personality quirk, which is jokingly catered to, and each cow is called by name. In every aspect of their operation Fisher and Fessard project

shrewd professionalism, efficiency and common sense. They have a good time, too, and so do the cows. Music is piped in during milking, and when I asked if it was for the cows' benefit, Fisher replied with a smile, "Well, we all enjoy it."

Fisher shudders at the thought of what the farm would be now if she hadn't taken it over. Not only would it have passed out of the family, to "the land would be lost to agriculture, chopped into tiny tracts. Someone comes by almost every month to see if I'll sell off a piece." Not likely.

BEAUTIFUL OATS

Melda Snyder, of Flemington, New Hersey, has managed her farm alone for eleven years since her husband died. It's a magnificent 530-acre area, which grows corn, wheat, oats and alfalfa, and supports beef and dairy cattle. With eyes trained from years of experience, Snyder can spot a bad row of corn among fields of good ones. "Now here's a really sad bunch, but aren't those the most beautiful oats you've ever seen? I learned how to run things through osmosis, really. Clifford and I always made decisions together, so when the time came, I knew enough about the farm to keep it going."

Today, in addition to managing her farm, Snyder is vice-president of the New Hersey State Board of Agriculture and is a prime mover and shaker for farmers in the area. Though she is mainly concerned with farm management, she is still not above driving the hay wagons, and she radiates a farmer's free spirit and self-sufficiency. "People wonder why we farmers are so independent; well, it's a great relief to know you can grow your own food, if necessary."

Though Snyder holds a variety of degrees, has studied architecture and managed school systems, she said of her farm life style. "I simply couldn't live any other way and be happy."

GREENGROCERIES

From North Carolina, Dorothy MacClean Slade drives to New York City every week with her family to sell their produce in the flourishing Greenmarket. She appears to love chatting with the shoppers who crowd the farmers' stalls, thrilled with the opportunity to buy directly from the farm. Her family has owned their farm for 40 years, and though Slade intended to be a nurse, she had to drop out of school for financial reasons and since has made a success of 300 cleared acres of land. "We grow everything you can name and love doing it. If my daughters want to take over the farm, that's great with me."

BIODYNAMIC FARMING

Of all these women, Anne Mendenhall has been actively farming the longest. She owns 280 acres near Aurora, New York and she capsulizes her 20-year career into a few lively

sentences: "In 1958, I left my Madison Avenue ad-agency job and came up to Cornell to study farming. I lived on a poultry farm and got a scholarship to put myself through school. One of my professors told me that Iowa was a farmer's promised land, that it had the best of everything. So off I went. When the best of everything eluded me, I came back to the Itahaca area. This place has been owned by a professor; he died, and his wife decided to sell it. I didn't have any money to put up, but she sold it to me on faith; I've been here ever since." Today, Mendenhall champions biodynamic farming and brings skeptical neighbors around to see the results she has obtained by using no commercial fertilizers or pesticides whatsoever. When we pulled up alongside her field of soy beans in neat, full, green rows, one male neighbor took a long, thoughtful look and said, with undeniable respect in his voice, "Well, I am impressed with those beans."

THE HIGH COST OF FARMING: HOW WOMEN ARE BEATING IT

Owning and operating a farm these days is far from simple, for men or women. Because land prices are now almost prohibitively high, most women who own their land have either inherited it or "married it." Equipment and supplies can run into thousands of dollars per year. In return for enormous capital and labor investment, the farmer receives a fraction of what the consumer spends on the food. Wheat growers argue, for example, that their grain pays them an amount equal to what it costs just to wrap loaves of bread in paper. Despite the odds, women who really want to farm can do so even without owning one. Some women, such as recently graduated Janet Gorst of upstate New York, job-hunt for farm work the way other women scout positions in business. Said Gorst: "My boss wanted someone who could do the job and was willing to learn new techniques. I tractor seed, do everything that I want to do."

Other women have joined in groups, like those who operate Critter Acres Farm in Penngrove, California. Cheryl Perry, who built up the business, rents land and leases a dairy along with two women friends, one of whom still holds down another job in order to pay farm bills. The farm produces goat milk and, so far, has held its own.

FARM - WOMEN'S LOBBIES: "IT'S ABOUT TIME WE HAVE SOMETHING!"

In addition to farms actually run by women, there is an extraordinary upsurge in activity on the part of farm wives. Nancy Smidle of Kewaunee, Wisconsin, for example, convened American Agri-Women (AAW) for the first time in 1974. "It was about time we women had something, she said. "Most farm women know farm operations as well as' the men do." AAW, which now has 32 state chapters, 3,000 individual members and a total of 30,000 members--if you include affiliated

women's organizations--serves as a powerful farm lobby. Other women's groups abound, and the newly formed Washington-based Rural American Women (RAW) has a task force at work developing action resolutions for women's agricultural issues.

Pursuing agricultural careers is not without the obstacles inherent when women chart paths previously assumed to be in the male domain. "You always have to work doubly hard to show you can do it," said one agriculture student. "Sometimes you get the feeling that the men don't really want you touching that valuable equipment," said another. Fisher suspects that her neighbors, who now are very supportive of her, originally believed she'd be out of business within a year. Other farm women complain that male workers have difficulty taking orders from females: "It's that Latin macho-American style," said one.

Women are proving by doing, though some hurdles require more concerted action. One of the primary focuses of women's lobby groups has been to challenge farm estate-tax laws. As written in most states, these laws view farm wives as the heirs of their husbands, not as their legal partners. Often, the death of a husband means a wife is liable for estate taxes, which could mean selling off the farm in order to pay them. Yet if a wife dies, no estate taxes are owed by the husband.

Legal convolutions vary from state to state and all farm women are advised to check their legal status and to plan estate transitions carefully. Joan Adams of Buffalo, Oklahoma, current president of AAW, said: "Unless a wife keeps a separate bank account and shows in dollars and cents what she has put into the farm, her work contribution means nothing to the IRS."

AGRICULTURE SCHOOLS AND FARMERS' GROUPS: WOMEN ARE GETTING PARITY

Colleges around the country are reevaluating their agriculture programs to provide curriculum equity for women, and Colorado State University held a recent conference expressly for that purpose. Well-established programs are also reflecting the new female ranks. Last summer, the Black Agriculturalists-a student group at Cornell's College of Agriculture and Life Sciences-operated a community garden for the Greater Ithaca Activities Center with an all-female staff-five young women, not all of whom had farm backgrounds. Witness Dinah Torres of Valley Stream, New York, who enrolled at Cornell because "agriculture has always seemed like a good thing to me."

This year, Cornell's entering class was 50 percent female, compared with 27 percent in 1967. Leslie Dines, who did her undergraduate work in environmental science and has general agricultural knowledge, was the college's first female recruiter. Her genuine enthusiasm and considerable energy make you wish you'd thought about an agri-

culture career yourself. To quote Dines, "If the 'hands-on' production farming seems too strenuous or demanding, there are many other routes to go. We are seeing women entering programs all across the curriculum."

Judy Massapny, director of information for the National Grange, agreed. "I don't know if we can say that more and more women are going into farming for themselves, but we certainly see many more women in the agriculture media, in sales promotion, in the research sciences and in the agri-businesses."

Almost no group attests to the growing role of women in agriculture as clearly as Future Farmers of America (FFA), an organization of high-school students preparing for agricultural careers, which for years actually barred women from entering. (They used to sneak in by registering with first initials only.) In 1969, reacting to the general pressure of the women's movement, the group opened its ranks to women, and today, approximately 15 percent of the 508,000 membership is female. Julie Smiley, who intends to make a career in agricultural journalism, was the first female national officer of FFA, followed by Peg Armstrong, a farmer national vice-president. Ten of the organization's 50 state presidents are female.

At a caucus of the young women delegates attending the group's recent conference in Washington, DC, nothing was as obvious as the diversity of their backgrounds. Some were born to the farm, but many others were city kids transplanted to the country, or ones who had chosen agriculture on their own. Each had an equally confident perspective: "Well, the time has come for women in agriculture, that's all," said one. "We can run things better than men, and they know it." quipped another.

President Carter, who had been an FFA member as a young man in Plains, spent 20 minutes with the entire FFA delegation at a special Rose Garden reception. He talked genuinely of their mutual love of the land, then shook hands and chatted with the delegates. One girl said the President looked slightly suprised to see her but, recovering, talked to her "farmer to farmer."

NEW RESPECT FOR AGRICULTURE: WOMEN ARE MAKING IT HAPPEN

Perhaps the most exciting aspect fo the women's movement in agriculture is the potential it has to draw together urban and rural people. As America begins to notice agri-women, it must begin to pay more careful attention to agriculture in general. The recent farmers' strike, consumer resistance to higher food prices and rising concern with food quality and food shortages have focused attention on the agricultural segment of the economy as never before. Jean Tetrault, coauthor with Sherry Thomas of Country Woman, predicts all this attention could lead to a "renaissance of the small farm." Perhaps she is overly optimistic, but at least we know that if women have anything to do with it, there will be a new respect for and appre-

ciation of agriculture.

As Jill Beckman of Elgin, Nebraska expressed it, "I'd just like to say that I'm glad you're doing this article, because I grew up being embarrassed to say I lived on a farm." One hopes these insecurities are long in the past of American farm women. After all, if intelligent, dynamic women have chosen agriculture as a viable career alternative, there's assuredly more to it than ee-i-ee-i-o.

CAREERS IN FARMING

AGRICULTURAL PRODUCTION-THE REAL NITTY-GRITTY

Be warned. This aspect of farming is not for everyone. The hours are long, the work arduous and the financial rewards of a small farm are erratic and meager at first. Success is possible, but those who farm do so more for the sheer exhilaration of seeing things grow, for the thrill of being close to the land, than for the money that could be in it.

Credit

Though no real data on the subject exist, access to credit to start a farm should be as available to women as to men. In addition to commercial-bank loans (the American Banking Association reports that there are at least 40 female agricultural loan officers around the country), the federal government provides agricultural credit through the Federal Land Bank System, the Cooperative Farm Credit System and the Production Credit Association. For information write:

The Farm Credit Administration
Washington, DC 20578

Education

Learn about the aspect of farming that most interests you and, as Anne Mendenhall recommends, "take little steps first." All the land-grant colleges-schools which were set up in the 18th century to disseminate higher education have schools of agriculture. There is a land-grant college in every state, and each one operated an extension service to provide outreach information from the colleges to interested farms. For information, write the land-grant college in your state.

AGRICULTURE-RELATED CAREERS

Here, the possibilities are numerous, not only for learning new skills, but also for applying old ones. Most of these jobs offer wide administrative, managerial and creative challenges. They include:

Agricultural Engineering - soil science, machinery design, farm waste management.

Agricultural Economics - farm management, business manage-

ment, international economy, agri-banking.

Agricultural Science - biology, botany, ecology, genetics, breeding, forestry, animal science, equestrian science.

Environmental Science - landscape architecture, aquatic and atmospheric study, natural-resource management.

Food Science - nutrition, food analysis.

Plant Science - vegetable crops, field crops, horiculture, pomology, ornamental horticulture, floriculture, plant breeding.

Sociology and Behavior, Communications - rural studies, agri-journalism, product marketing, sales promotion, data collection.

Agricultural Education - teaching agricultural subjects.

For more information on careers in agriculture, write the college of your choice or:

National Association of Land-Grant Colleges
One Dupont Circle
Washington, DC 20036

PUBLICATIONS

The Department of Agriculture publishes numerous brochures on every aspect of agriculture, many of which are free.
Write:

US Department of Agriculture
Publications Division, GPA
Washington, DC 20250

Also order a copy of the 1978 US Department of Agriculture Yearbook, entitled Making It on a Few Acres, from:

Superintendent of Documents
Government Printing Office
Washington, DC 20402

Another fine source of practical farming tips is Country Woman, by Sherry Thomas and Jean Tetrault, Anchor Press, 1976, \$6.95.

Planned Course Statement

Department: Vocational AgricultureCourse Title: Agriculture I () Course Number:
Alternate Title
(for the imaginative)Length of Course: 36 weeks No. of Credits: 1 Grade Level: 9Prerequisite: None Credit by Exam Available ☐ yes ☐ no

Check one: Alternate Learning Opportunities (check one)
☐ Required ☐ Does Not Apply (or more)
☐ Selective ☐ Independent Study
☒ Elective ☐ Off-Campus Experience
☒ Other (Explain in Course Overview)

Course Overview: The course will provide students who have a career interest in agricultural occupations those fundamental concepts and skills necessary to explore and begin preparation for further career refinement and entry-level employability. Classroom instruction will be combined with laboratory activities, leadership activities, and the Future Farmers of America (FFA) activities to enhance learning. Supervised Occupational Experience Programs in the form of on the farm projects, cooperative work experience in agriculture, supervised laboratory experience, agricultural services projects, and/or farm and/or homestead improvement projects are required of those students who participate in Agriculture I for the purpose of developing on-the-job skills and refining tentative career choices.

Program Goal at Agriculture I Level:

The student will:

1. Understand and explore basic agricultural principles and careers which impact production agriculture and agri-business occupations in the employment region served by the high school.
2. Make tentative career choices based on their abilities, aptitudes, interests, and values.

Course Objectives:

Upon completion of this course the student will be able to:

1. Safely operate and perform basic preventive maintenance on agricultural tractors and equipment.

2. Qualify, at age 14 and 15, for a tractor operators permit.
3. Discuss the organization and operation of a local FFA chapter and describe the purpose of the organization.
4. Explain the meaning and value of the FFA creed.
5. Properly prepare a small gasoline engine for winter storage.
6. Identify, describe advantages and disadvantages of, and select Beef Cattle breeds.
7. Understand common beef industry terminology and basic management practice.
8. Plan an educationally valid Agricultural SOEP.
9. Gain necessary financial support and initiate an approved SOEP.
10. Complete necessary financial records on their SOEP in the Oregon project record book.
11. Apply correct parliamentary procedure in a meeting situation.
12. Identify, select, and know advantages and disadvantages of sheep breeds.
13. Understand common sheep industry terminology and basic management practices.
14. Identify, select, and know advantages and disadvantages of swine breeds.
15. Understand common swine industry terminology and basic management practices.
16. Perform agricultural mechanics operations in the areas of basic arc and oxy-acetylene welding, basic wood construction, cold metal working and tool reconditioning.
17. Explain the economic value of the plant production industry to Oregon's economy.
18. Explain basic plant functions and describe how they relate to plant production.

Learning Activities:

1. Individual and group projects.
2. Group discussion.
3. Teacher and resource person presentations.
4. Field trips to local Farms, Ranches, Agri-businesses, and Agricultural Shows.
5. Viewing slide, films, and filmstrips.
6. Participation in classroom contests and completion of worksheets and study guides.

7. Participation in FFA meetings, activities and contests.
8. Participation in SOEP program.
9. Set tentative occupational goals and work toward them--revise goals as needed at the end of the year (or whenever appropriate).
10. Participate in decision making process as applied to instructional areas and goal setting throughout the course.

Assessment Procedures:

1. Written and oral assignments.
2. Individual and group projects.
3. Written and performance tests.
4. Notebook of technical material.
5. SOEP program evaluation.
6. Observation by teacher.
7. One-to-one conferences between teacher and student.

E.D

Advanced Planning for Course

Some materials must be ordered in the summer in order to have them on hand when needed. Below is a list of early planning considerations.

1. Order films in June-July or earlier.
Major free loan film companies are:
 - a. The Farm Film Foundation
1425 H. St., N.W.
Washington, DC. 20005
 - b. Modern Talking Pictures Service, Inc.
#16 Spear St.
San Francisco, Ca. 94105
 - c. Vernard Films Ltd.
Box 1332
Peoria, IL. 61601
 - d. Educational Films
The Farm Credit Banks of Wichita
151 North Main
Wichita, Kansas 67202
 - e. Safer Oregon
Worker's Compensation Department
Accident Prevention Division
Labor and Industries Bldg.
Salem, Oregon 97310

Write and get catalogs from these firms and place orders early. For additional film company addresses see below:

- | | |
|---|--|
| 1. Allis-Chalmers
Ideal Pictures Film Library
4431 West North Ave.
Milwaukee, WI 53208 | 5. American Quarter Horse Assn.
Film Reservations
2736 West 10th,
Armarillo, TX 97168 |
| 2. Amchem Products, Inc.
Agricultural Div.
Advertising Dept.
Ambler, PA 19002 | 6. American Sheep Producers Council
200 Clayton
Denver, Colorado 80206 |
| 3. American Cyanamid Co.
David Butterfield
Agricultural Division
P.O. Box 400
Princeton, NJ 08540 | 7. Armco Steel Corporation
Training Division
7000 Roberts St.
Kansas City, MO 64125 |
| 4. American Farm Bureau Federation
Information Division
225 Touhy Ave.
Park Ridge, IL 60068 | 8. Audio Visual Productions Inc.
1233 N. Ashland Ave.
Chicago, IL 60622 |
| | 9. BASF Wyandotte Corporation
100 Cherry Hill Road
Parsippany, NJ 07054 |

Addresses Continued:

10. Babson Bros.
Babson Bros. Company
2100 South York Road
Oak Brook, IL 60521
11. Blue Anchor, Inc.
Walter Tindell
P.O. Box 15498
Sacramento, CA 95813
12. JI Case Co.
Ag Equip. Division
700 State St.
Racine, WI 53404
13. Caterpillar Tractor Co.
100 N.E. Adams
Peoria, IL 61629
14. Deutz Corporation
7385 Ponce de Leon Circle
Atlanta, GA 30340
15. Dickey-john Corporation
Films
P.O. Box 10
Auburn, IL 62615
16. Dow Chemical U.S.A.
Film Library
P.O. Box 1706
Midland, ML 48640
17. E.I. Du Pont & Co.
Advertising Department
Audio Visual Section
Wilmington, DE 19698
18. Elanco
Annette Proctor, Film Library
Eli Lilly & Co.
Indianapolis, IN 46206
19. Elliott Films
2635 Nicollet Ave.
Minneapolis, MN 55408
20. Energy Film Library
DOE Technical Info Center
P.O. Box 62
Oak Ridge, TN 37830
21. The Farm Film Foundation
1425 H St. NW
Washington, DC 20005
22. Farmbank Services
Joe Brasher
12000 E. 47th Ave.
P.O. Box 39088
Second Floor
Denver, Colorado 80239
23. The Fertilizer Institute
1015 18th St. NW
Washington, DC 20036
24. Gehl Company
Marketing Services
143 Water Street
West Bend, WI 53095
25. Golden Harvest Seeds, Inc.
Charles R. Finley, Exec VP
513 E. Locust St.
Bloomington, IL 61701
26. Grain Terminal Association
P.O. Box 43594
167 Snelling Ave. N
St. Paul, MN 55164
27. Grinnell Mutual Reinsurance Co.
Public Relations Dept.
1-80 at Highway 146
Grinnell, IA 50112
28. Gulf Oil Corporation
Public Relations Dept.
Bulf Building
Pittsburgh, PA 15230

Addresses Contined:

29. Holstein-Friesen Association
Box 808
Brattleboro, Vermont 05301
30. ICI Americas Inc.
Wilmington, DE 19897
31. International Minerals & Chemical Corp.
Audio Visual Dept.
501 E. Lange Street
Mundelein, IL 60060
32. International Harvester
International Photographic Center
International Harvester
Route 71 & Harvester Road
Sheridan, IL 60551
33. Iowa Farm Bureau Federation
Wendall Jarvis, Creative Visuals
5400 University Ave.
West Des Moines, IA 50265
34. University of Iowa
Media Library
Iowa City, IA 52240
35. Kalo Laboratories, Inc.
9233 Ward Parkway
Kansas City, MO 64114
36. Lindsay Manufacturing Co.
Russ Carlton, Adv & Promotion
Box 156
Lindsay, NE 68644
37. University of Maryland
Audio-Visual Services Dept.
Annapolis Hall
College Park, MD 20742
38. Modern Talking Picture Service Inc.
Rosanne Pollack
5000 Park St. N.
St. Petersburg, FL 33709
39. Monsanto Agricultural Products
Larry Evetts
800 N. Lindbergh Blve.
St. Louis, MO 63166
40. National Cotton Council of America
P.O. Box 12285
Memphis, TN 38112
41. National Rural Electric Cooperative Assn.
2000 Florida Ave. N.W.
Washington, D.C. 20009
42. North Dakota State Film Library
North Dakota State University
Fargo, ND 58102
43. Occidental Chemical Co.
Public Relations Dept.
P.O. Box 196
Lathrop, CA 95330
44. Owatonna Manufacturing Co., Inc.
Bob Duncan
PO Box 547, Hwy 45 N.
Owatonna, MN 55060
45. Ralston Purina
Checkerboard Square
St. Louis, MO 63188
46. Roche Chemical Co.
340 Kingsland St.
Nutley, NJ 07110
47. Rohm and Haas Company
Librarian
Independence Mall West
Philadelphia, PA 19135
48. Schwartz Manufacturing,
Division of Chromalloy
129 Pine St. South
Lester Prairie, MN 55354

Addresses Continued:

49. Select Sires Inc.
11740 U.S. 42
Plain City, OH 43064
50. Shell Film Library
1433 Sadlier Circle W. Dr.
Indianapolis, IN 46239
51. Sioux City Livestock Market News
Foundation
128 Livestock Exchange Building
Sioux City, IA 51107
52. Smith Kline Animal Health
karol Media
933 Pacific Avenue,
Kansas City, MO 66101
53. Bill Snyder Films, Inc.
Box 2784
Stoneville, MS 38776
54. Soil Enterprise Corp.
P.O. Box 128
Stoneville, MS 38776
55. Sperry New Holland
Public Relations Dept.
New Holland, PA 17557
56. Steiger Tractor Inc.
Box 6006
3101 1st Ave. North
Fargo, ND 58102
57. Tri-State-Breeders Cooperative
Director of Public Relations
Westby, WI 54667
58. The Upjohn Company
Corporate Film Library
7000 Portage Road
Kalamazoo, MI 49001
59. USS Agri-Chemicals
Alan Kendall
PO Box 1685
Atlanta, GA 30301
60. Vermeer Manufacturing Co.
Jaap Kroes
Box 200
Pella, IA 50219
61. Washington State University
Instructional Materials Center
Pullman, WA 99164
62. White Farm Equipment
Merchandising Dept.
2625 Butterfield Rd.
Oak Brook, IL 60521

2. Get current commodity data information sheets. Annually updated sheets are available in January from:

Stan Miles
219 Extension Hall
Oregon State University
Corvallis, Oregon 97331
(Phone 754-4821)

- a. Get both, "Oregon's Leading Agricultural Commodities" and "Oregon Gross Farm Sales Preliminary Estimates".
- b. Copies of 1980 data sheets are included in this packet as examples. Get up-dated sheets each January.

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,674
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*

TOTAL CROSS FARM SALES	1,742,337	1,494,437	1,253,984
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p - Preliminary r - Revised *Includes nursery crops and turf sod.

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
thousand dollars															
THE STATE....	345,401	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,196	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	32,611	74,073	63,213	28,650	205,547	708,614
Benton.....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,683	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,429
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	5,334	25,837	89,409
Marion.....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	158,598
Multnomah...	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington...	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Coos.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook...	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	296	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	---	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,117	1,509	18,009	38,735
Josephine...	56	439	---	1,061	275	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	398,246
Gilliam....	20,227	199	226	108	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Hood River...	---	172	---	---	35,219	85	72	840	36,388	563	506	315	277	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Unatilla...	83,314	6,121	794	19,921	12,237	106	12,167	2,709	137,350	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,892	2,448	3	814	20,157	26,517
Malheur....	18,769	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,150	30,108
Wallowa....	6,244	2,075	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes...	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,934	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Harney....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson...	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,980	682	1,960	36,822	83,619
Lake.....	1,431	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

OREGON
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Gross & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Little & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
thousand dollars															
THE STATE...	236,959	48,615	93,081	118,742	105,402	27,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,474,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,252
Benton....	3,870	386	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas...	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,860	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah..	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,602	1,823	12,443	44,495
Washington..	11,112	2,158	5,182	930	5,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop....	---	43	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,886	4,744	6,838
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,780
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook..	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,571
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,888	2,316	1,185	16,536	37,380
Josephine..	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	582	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River..	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,630	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	72,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,540	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	766	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa....	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes...	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,986
Jefferson...	4,215	1,638	4,645	12,043	---	---	307	120	27,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

3. Breed Association Addresses:

Breed association addresses are printed each year in "Agri-Educator". "Agri-Educator" is published twice yearly and can be obtained from the following address:

Agri-Educator
5520-G Touhy Ave.
Skokie, IL. 60076

For your convenience a list of 1980 addresses are as follows:

A teacher's guide to livestock register associations

AgI-I-26

cattle

American Angus Association — C.K. Allen, Secretary, 3201 Frederick Blvd. St. Joseph, MO 64501

American Beefalo Association — James C. Pendleton, Executive Director, 200 Semonin Bldg, 4812 U.S. Hwy 40, Louisville, KY 40222

American Brahman Breeders Association — Wendell Schronk, Secretary, 1313 LaConcha Lfde, Houston, TX 77054

American Chianina Association — Jack Phillips, Chief Executive Officer, PO Box 11537, Kansas City, MO 64138

American Dexter Cattle Association — Daisy Moore, Secretary, 707 W. Water St., Decorah, IA 52101

American Galloway Breeders' Association — 302 Livestock Exchange Bldg, Denver, CO 80216

American Guernsey Cattle Club — Max L. Dawdy, Secretary-Treasurer, Peterborough, NH 03458

American Hereford Association — H.H. Dickenson, Secretary, 715 Hereford Dr., Kansas City, MO 64105

American-International Charolais Association — Charolais & Charbray — Don Nelson, Records Secretary, 1610 Old Spanish Trail, Houston, TX 77054

American Jersey Cattle Club — J.F. Cavanaugh, Executive Secretary, 2105-J S. Hamilton Rd., Columbus, OH 43227

American Maine-Anjou Association — Secretary, 564 Livestock Exchange Bldg., Kansas City, MO 64102

American Milking Shorthorn Society — Harry Clambett, Secretary, 1722-JJ S. Glenstone, Springfield, MO 65804

American Murray Grey Association — Joan Turnquist, Secretary, Box 30085, Billings, MT 59101

American Pinzgauer Association — Emmett N. Carter, Executive Secretary, PO Box 1003, Norman, OK 73069

American Polled Hereford Association — Ed Bibe, 4700 E. 63rd St. Kansas City, MO 64130

American Polled Shorthorn Association — 223d Hascall St., Omaha, NE 68124

American Red Poll Association — Verdel H. Severin, Secretary, 3275 Holdrege St., Lincoln, NE 68503

American Scotch Highland Breeders Association — John C. Stronk, Secretary, 508 Main St. Wausenburg, CO 81089

American Shorthorn Association — C.D. Swaffar, Executive Secretary, 8288 Hascall St., Omaha, NE 68124

American Simmental Association — Don

Vaniman, Executive Secretary; Earl Peterson, Executive Administrator, One Simmental Way, Bozeman, MT 59715

Ayrshire Breeders' Association — David Gibson, Jr., Executive Secretary, Brandon, VT 05733

Brown Swiss Cattle Breeders' Association of U.S.A., Inc — Evans Wright, Secretary, Box 1038, Beloit, WI 53511

Devon Cattle Association, Inc — S.H. Fowler, Executive Secretary, PO Drawer 628, Uvalde, TX 78801

Dutch Belted Cattle Association of America, Inc — James H. Hendrie Sr., Secretary-Treasurer, PO Box 358, Highlands County, Venus, FL 33960

Holstein-Friesian Association of America — Zane Akins, Executive Secretary, Box 808, Brattleboro, VT 05301

International Brangus Breeders Association — Don Pitts, Executive Secretary, 9500 Tioga Dr., San Antonio, TX 78230

International Illawarra Association — Harry Clambett, Executive Secretary, 1722-JJ S. Glenstone Ave., Springfield, MO 65804

North American Limousin Foundation — Greg L. Martin, Executive Vice President, 100 Livestock Exchange Bldg., Denver, CO 80216

Performance Registry International — PO Box 133, Joplin, MO 64601

Red Angus Association of America — Lyle V. Springer, Secretary, PO Box 776, Denton, TX 76201

Santa Gertrudis Breeders International — Don Wideman, Executive Vice President, PO Box 1257, Kingsville, TX 75663

Texas Longhorn Breeders Association of America — David Sweet, Executive Director, 18519, 205 Alamo Plaza, Menger Hotel, San Antonio, TX 78205

horses—jacks—ponies

American Quarter Horse Association — Ronald Blackwell, Executive Secretary, 2736 W. 10th St., Amarillo, TX 79168

American Paint Horse Association — Ed Roberts, Secretary, PO Box 16519, Ft. Worth, TX 76118

American Saddle Horse Breeders' Association — T.J. Morton, Jr., Secretary, 929 S. 4th St., Louisville, KY 40203

American Shetland Pony Club — Arthur L. Cook, Secretary, PO Box 435, Fowler, IN 47344

American Shire Horse Association, Inc — Heather D. Erskine, Secretary, 14410 High Bridge Rd., Monroe, WA 98272

American Suffolk Horse Association — J.R. Coughlin, Secretary, 672 Peik Blvd., Des Moines, IA 50312

Appaloosa Horse Club — George B. Hatley, Secretary, Moscow, ID 83843

Arabian Horse Registry of America — Ralph A. Clark, Secretary, 3435 South Yosemite St., Denver, CO 80231

Belgian Draft Horse Corp of America — Blanche A. Schmaizner, Secretary-Treasurer, Wabash, IN 46922

Clydesdale Breeders of U.S. — Betty J. Groves, Secretary, RR 1, Box 131, Pecatonica, IL 61063

Fox Trotting Horse Breed Association Inc — Lawrence Barnes, Secretary, 201 S.E. Third St., Box 537, Ava, MO 65608

International Arabian Horse Association — PO Box 4502, 224 E. Olive, Burbank, CA 91503

Morgan Spotted Horse Association of America — Lowell H. Rott, Secretary-Treasurer, RR 1, Riddell, IL 61067

The Palomino Horse Association, Inc — Robert E. Dailmeier, Secretary, PO Box 324, Jefferson City, MO 65101

Paint Horse Breeders of America — Melrose Spivey, Executive Secretary, Box 211, Mineral Wells, TX 76067

Percheron Horse Association of America — Louis Gossett, Secretary-Treasurer, RR 1, Beavert, OH 43718

The Pinto Horse Association of America, Inc — Fred and Milburn, President, Suite C, 7525 Mission Gorge Rd., San Diego, CA 92120

Pony of the Americas Club, Inc — Gerry Freeman, Executive Secretary, Box 1147, Mason City, IA 50401

Tennessee Walking Horse Breeders & Exhibitors Association — PO Box 281, Leakey, TN 37091

United States Trotting Association (Standardbred) — Edward F. Hackett, Executive Vice President, 750 Michigan, Columbus, OH 43215

Welsh Pony Society of America — Gail Heston, Secretary, PO Drawer A, White Post, VA 22663

swine

American Berkshire Association — Merrill Smith, Secretary, 601 W. Monroe St., Springfield, IL 62704

American Landrace Association, Inc — J. Steven Morrissey, Executive Secretary, PO Box 247, Lebanon, IN 46062

American Yorkshire Club, Inc — Gen. Conatter, Secretary, Box 2417, West Lafayette, IN 47906

(more on page 64)

LIVESTOCK ASSOCIATIONS/continued

Chester White Swine Record Association — Dan Parrish, Executive Secretary, 817 E. 9th St., Box 228, Rochester, IN 46975

Hampshire-Swine Registry — Larry L. Rus, Secretary, 1111 Main St., Peoria, IL 61606

National Spotted Swine Record, Inc. — Bill Newham, Secretary, 110 Main, Bainbridge, IN 46105

National Hereford Hog Record Association — Ruby Schrecengast, Secretary-Treasurer, RR 1, Flandreau, SD 57028

OIC Swine Breeders' Association, Inc. — Thomas R. Hendricks, Secretary-Treasurer, RR 2, Box 166, Cloverdale, IN 46120

The Poland China Record Association — Don Nikodim, Secretary, PO Box 71, Galesburg, IL 61401

Tamworth Swine Association — William R. Horne, Secretary, Rt 2, Box 126A, Hillsboro, OH 45133

United Duroc Swine Registry — Bruce A. Henderson, Executive Secretary, 1803 W. Detweiler Dr., Peoria, IL 61614

sheep and goats

American Angora Goat Breeders' Association — T.L. Taylor, Secretary-Treasurer, Rocksprings, TX 78880

American Cheviot Sheep Society, Inc. — Henry Kuykendall, Secretary, RR 2, Lebanon, VA 24266

American Corriedale Association, Inc. — Russell E. Jackson, Secretary-Treasurer, Box 29C, Seneca, IL 61360

American Dairy Goat Association — Don Wilson, Secretary-Treasurer, PO Box 865, Spindale, NC 28160

American and Delaine-Merino Record Association — Harold E. Simms, Secretary, Aleppo, PA 15310

American Goat Society, Inc. (Dairy Goats — Purebred Registry) — Wayne Hamrick, Secretary, 1606 Colorado St., Manhattan, KS 66502

American Hampshire Sheep Association — Jim Cletcher, Secretary-Treasurer, RR 10, PO Box 199, Columbia, MO 65201

American Down Record Association — George Reimlinger, Secretary, 160 Elm Court Dr., Zionsville, IN 46077

The American Rambouillet Sheep Breeders' Association — Mrs. LaVene McDonald, Secretary-Treasurer, 2709 Sherwood Way, San Angelo, TX 76901

American Romney Breeders' Association — John H. Landers, Jr., Secretary, 4375 N.E. Westlawn Dr., Corvallis, OR 97330

American Shropshire Registry Association, Inc. — Elizabeth R. Glasgow, Secretary,

PO Box 1970, Monticello, IL 61856

American Southdown Breeders' Association — Florence W. Strouse, Secretary, RR 4, Box 14B, Bellefonte, PA 16823

American Suffolk Sheep Society — Mrs. VeNeal Jenkins, Secretary, 55 E. 100 North, Logan, UT 84321

Black Top & Delaine-Merino Sheep Breeders' Association — Irwin Y. Hamilton, Muse, PA 15350

Columbia Sheep Breeders' Association of America — Richard L. Gerber, Secretary, PO Box 272, Upper Sandusky, OH 43351

Continental Dorset Club — J.R. Henderson, Secretary, PO Box 577, Hudson, IA 50643

Karakul Fur Sheep Registry — Ted Stutz, Secretary, Fabius, NY 13063

Montadale Sheep Breeders Association — Anne Gregory, Secretary, PO Box 1007, East St. Louis, IL 62204

National Suffolk Sheep Association — Betty Sheller, Secretary, PO Box 324, Columbia, MO 65201

National Tunis Sheep Registry, Inc. — Patricia J. Swartz, Secretary, 1826 Nesbit Rd., Attica, NY 14011

U.S. Targhee Sheep Association — Wayne Thayer, Secretary-Treasurer, 726 Terry Ave., Billings, MT 59102

4. Breed Identification Slides

a. Up-to-date breed identification slides are available from:

1. Vocational Instructional Services
F.E. Box 182
Texas A&M University
College Station, Texas 77842
2. Vocational Agriculture Service
343 Mumford Hall
Urbana, IL. 61801

F. Curriculum Validation Statement

1. A research study of Oregon manpower needs in agriculture was conducted to determine agricultural titles which have potential for placement of high school graduates in Oregon.
2. McClays study on competencies needed by persons employed with various occupational titles was used to assess the coverage of the technical agricultural material in the curriculum guide.
3. With all competencies covered over the four-year curriculum the guide was considered valid for use in Oregon.
4. A group of fifteen (15) Oregon Vocational Agriculture teachers formed the curriculum project advisory committee and provided guidance for scope and sequence of the materials. They also provided input for the format of the curriculum guide. It was with sincere appreciation that the efforts of the curriculum advisory committee be recognized.

It was the feeling of the project staff that the best source of information for curriculum content and format for vocational agriculture teachers in Oregon were the vocational agriculture teachers themselves. The names of the advisory committee members were listed in the Preface of the introduction.

G. The Four Year Unit Outline:

The four year unit outline which was developed by the curriculum Advisory Committee as a guide for vocational agriculture instruction in Oregon follows. This guide was developed and validated using the manpower data matrix which was presented in section E, immediately preceding this discussion.

Program Name Oregon Vo-Ag Curriculum

Week		Special Events	FIRST YEAR-(1st and 2nd) Semesters	SECOND YEAR-(3rd and 4th) Semesters
Number	Date		Name of Course <u>AgI</u>	Name of Course <u>AgII</u>
1			-Intro. Vo-Ag Prog., SOEP, FFA	-Intro. & Records Update
2			-Tractor Operation & Safety	-Fencing (2 weeks)
3			(4 weeks)	-Fencing
4	Fri	Check Record	↓	-Soils (6 weeks)
5		Books (except Frosh)		Texture, Structure, Slope
6			-FFA:History, Org., Programs	Drainage, Limitations,
7			(3 weeks) Creed & Introduction	pH, soil testing,
8	Fri	Check Record	to Public Speaking	Evaluation (Judging)
9		Books (except Frosh)	Prev. Maint. and -Small Engines: Winterization	Fertilizers & Fertilizer Recomm.
10			-Intro. to Beef: Breeds, Parts,	- Animal Nutrition (4 weeks)
11			Term, Selection, Thumb Rules Mgmt	" "
12	Fri	Check Record	-SOEP: Decision Making - Select	Ration Formulation
13		Books (except Frosh)	Project, Begin Record Book	" "
14			-Parliamentary Procedure	-Extemporaneous Spk. (2 wks)
15			(3 weeks)	" "
16	Fri	Check Record	↓	-Record Books
17		Books	-Christmas Vacation XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
18			-Intro. to Sheep: Breeds ID, Parts	-Parliamentary Procedure (2wks)
19			Term., Selection, Thumb Rules (1½wk)	" "
20			-Local Adaption-Animal	-Advanced Ferrous Welding (5wks)
21	Fri	Check Record	Science (2½ weeks)	
22		Books	-Intro. to Swine: Breeds, Parts	Arc (vertical & horizontal)
23			Term., Sel., Thumb Rules (1½wks)	O-A (braze, weld & cut

Program Name Oregon Vo-Ag Curriculum (Continued)

Week		Special Events	FIRST YEAR-(1st and 2nd) Semesters	SECOND YEAR-(3rd and 4th) Semesters
Number	Date		Name of Course <u>AgI</u>	Name of Course <u>AgII</u>
24			-Shop:Safety, Skills Demo.,Tool	" "
25	Fri.	Check Record	ID, & Basic Plans Reading	-Tillage Equip. (3 weeks)
26		Books	Intro. to: Arc	Plow, Disc, Harrows,
27			O-A } 2 weeks	Cultivators&Seedbed Prep.&
28			-Spring VacationXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Planting
29			Wood Project } 2 weeks	-Plant Sci: Local Adaptation
30				(4 Wks) Crops (Forages & Cereal)
31			Tap & Die } 2 weeks	or
32			Tool Fitting }	Horticulture
33			-Plant Sci: Local adaptation	-Livestock Skills (4 wks)
34	Fri.	Check Record	Crops &/r Hort.	" "
35		Books	↓ (4 weeks)	" "
36			↓	" "
37			-Showing & Fitting: Beef	-Livestock Selection Review
38	Fri.	Check Record Books	Sheep, Swine -Close school	" "

*Note: Career information is to be inserted in each unit as it is covered-
there is no separate career unit.

Program Name Oregon Vo-Ag Curriculum

Week		Special Events	THIRD YEAR-(5th and 6th) Semesters	FOURTH YEAR-(7th and 8th) Semesters
Number	Date		Name of Course <u>AgIII</u>	Name of Course <u>Ag IV</u>
1			-Intro. & Record Update	-Intro. & Record Update
2			-Land Measurement & (2 weeks)	-Irrigation Systems (2 Wks)
3			Surveying	" "
4	Fri.	Check Record	-Animal Production (6 Weeks)	-Production Records (2Wks)
5		Books (except Frosh)	Genetics, Breeding Programs,	" "
6			A.I., Palpation	-Projects (6 Weeks)
7			Health,	"
8	Fri.	Check Record	Sanitation & Diseases	"
9		Books (except Frosh)	(symptoms, prevention, cure)	"
10			-Electric Wiring (2 Weeks)	"
11			" "	"
12	Fri	Check Record	-Electric Motor Maint. (2 weeks)	-Farmstead Layout (3 Weeks)
13		Books (except Frosh)	" "	Lighting, storage, corral
14			-Plumbing (1 week)	systems, & ventilation
15			-Informative Speaking	-Persuasive Speaking
16	Fri	Check Record	-Record Books	-Record Books
17		Books	Christmas VacationXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
18			-Applications(St. Farmer, Profic.)	-Farm Taxes (2 Weeks)
19			-Non-Ferrous & Repair Welding(4 Wk)	" "
20			Metal Identification	-Ag Financing, Farm Law, (4 Wks)
21	Fri	Check Record Books	Aluminum, Cast Iron,	Ag Agencies and
22			Hardsurfacing, High Carbon Steel	Machinery Management
23			-Preventive Maintenance (3 Wks.)	" "

AgI-1-31

Program Name Oregon Vo-Ag Curriculum

Week		Special Events	THIRD YEAR-(5th and 6th) Semesters	FOURTH YEAR-(7th and 8th) Semesters
Number	Date		Name of Course <u>AgIII</u>	Name of Course <u>Ag IV</u>
24			Tractors and Machinery	-Agricultural Cooperatives,(4Wks)
25	Fri.	Check Record	Hydraulic Systems	Agricultural Marketing
26		Books	Meats (2 weeks)	(Futures, Contracts,
27			"	Open market, etc.)
28			-Spring VacationXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
29			-Plant Science:Local adaptation	-Pesticides (3 Wks.)
30			(5 Wks)Berry Prod.orGrass Seed Pro.	safety, applicator license,
31			or, Nursery Production or, Land-	equipment calibration
32			scape Design or, Christmas Tree	-Building Construction (7 Wks)
33			Production or, Range	concrete
34	Fri.	Check Record	-Harvesting Equipment (5 Wks)	building materials
35		Books	Combines,	building nomenclature
36			Balers-Swathers,	build a small structure
37			Forage Harvestors,	" " "
38	Fri.	Check Record	Sp ialty Equipment	" " "
		Books	Appendix - Bees & Chainsaws	

*Note: Career information is to be inserted in each unit as it is covered there is no separate career unit.

ORIENTATION

TEACHERS USE GUIDE

1. This unit is designed to help you orient students to your vocational agriculture program during the first week of class.
2. Included is:
 - a. Unit Calendar for the year
 - b. Objectives for the Orientation Lesson
 - c. Outline for the Orientation Lesson
 - d. Vo-Ag Department Policies
 - e. Notebook Requirements
 - f. SOEP Question and Answer Sheets
 - g. SOEP Policy Sheet
 - h. FFA Information Sheet
 - i. Classroom Management Suggestions
 - j. Example Calendar of Activities
3. You should, in the process of teaching this unit, hand out a, d, e, f, g, h, and j from the above list.
4. From number two above, items f, g, and h can be used during summer recruitment efforts and also may be given or mailed to parents to help explain the program.
5. The calendar of activities should be completed prior to the opening of school. The FFA executive committee normally has the responsibility of finalizing the program of activities. A good way to complete the program of activities with student input is to have a chapter leadership camp during the summer months.

AG I - UNIT CALENDAR

<u>Unit Title</u>	<u>Suggested Duration</u>
ORIENTATION, INTRO TO VO-AG	5 days
TRACTOR OPERATION AND SAFETY	20 days
FFA AND CREED SPEAKING	15 days
SMALL ENGINES MAINTENANCE	5 days
INTRODUCTION TO BEEF PRODUCTION	10 days
SOEP - RECORD KEEPING	12 days
PARLIAMENTARY PROCEDURE	15 days
INTRODUCTION TO SHEEP PRODUCTION	8 days
LOCAL LIVESTOCK ADAPTATION	12 days
INTRODUCTION TO SWINE PRODUCTION	8 days
SHOP SAFETY AND DEMONSTRATIONS	10 days
INTRODUCTION TO WELDING	10 days
WOOD CONSTRUCTION PROJECTS	10 days
TAP AND DIE USE	5 days
TOOL FITTING	5 days
PLANT SCIENCE	20 days
SHOWING AND FITTING LIVESTOCK	10 days

NOTE: The above suggested durrantion for each unit of instruction includes a "best time"factor of approximately twenty percent. The instructor may find that about 20% of the instructional time may be consumed by other non-instructional activities (assemblies, meetings, athletic events, weather closure days etc.)

INTRODUCTION TO VOCATIONAL AGRICULTURE

OBJECTIVES:

Upon completion of this unit the student will:

1. Know what they will learn if they stay in Vocational Agriculture for 4 years.
2. Understand that SOEP is a requirement and a major part of the program.
3. Take information home pertinent to the Vocational Agriculture program.
4. Purchase a notebook and keep all information from Vocational Agriculture class in it.
5. Know and understand the classroom rules and school policies.
6. Understand the grading system used in Vocational Agriculture.
7. Appreciate the value of FFA participation as a major part of the total Vocational Agriculture program.
8. Understand the total program concept of SEOP-Classroom Instruction-FFA.

OUTLINE OF UNIT

- I. School Policies
 - A. Student Handbook
- II. Introduction to Vo-Ag (outline on board or prepare handout from Section I-G).
 - A. 4 year curriculum and unit calendar (emphasis on first year of program)
 - B. What to expect
- III. SOEP Requirement
 - A. Discuss Handout
 - B. Take handout home to parents
- IV. FFA
 - A. Discuss Handout
 - B. Discuss Calendar of Activities
- V. Notebook Requirements
 - A. Distribute Handout
 - B. Discussion
- VI. Grading
 - A. Classwork grade
 - B. SOEP grade
- VII. Student Control Plan
 - A. Handout
 - B. State a few of your own rules and expectations
 - C. Allow students to help you set rules and goals for the learning environment.
- VIII. Total Program Concept-Summary
 - A. FFA-SOEP-CLASSROOM
 - B. Explain how each fits into the program

SUBJECT MATTER OUTLINE

I. School Policies

A. Student Handbook

1. Most administrations want teachers to go over the student handbook with students the first period of the first day of a new school year. If this is the case, comply.

II. Introduction to Vocational Agriculture

(Put 4-year unit calendar on the chalk board or prepare a handout to distribute to the students--ie. Section I-G of this curriculum guide).

NOTE: It should be noted that the Oregon curriculum guide is intended to be a guide only. Teachers should adjust the curriculum outline provided to assure coverage of technical agriculture skills and knowledge that is pertinent to the local area.

VOCATIONAL AGRICULTURE TEACHERS-
PLEASE ADJUST THIS CURRICULUM TO FIT YOUR
LOCAL COMMUNITY NEEDS!!!!!!!

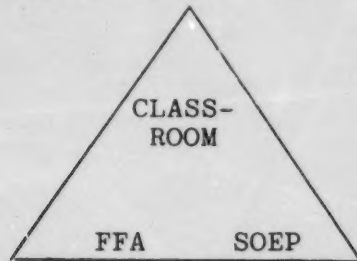
A. What is Agriculture?

To many people, agriculture is thought to be the production of plants and animals to provide the food and fiber for the people of the world. However, agriculture is more than that. Agriculture includes all occupations where knowledge, skills, and abilities are necessary for a person to enter into an agricultural occupation. Agriculture includes farmers, ranchers, buyers and sellers of agricultural products, agricultural mechanics, cowboys, inspectors, salesmen, chemists, teachers, scientists, economists and many other occupations. The total picture of agriculture includes the pure and applied science necessary to get the raw materials onto the supper table.

B. What is Vocational Agriculture?

Vocational Agriculture is an elective subject, offered students who want to work in some phase of agriculture. Vocational agriculture is designed to help prepare students to enter into an agricultural occupation and/or go on to further their education at a community college or at an agricultural college.

Vocational Agriculture has three main components to the program. Vocational agriculture can be pictured like this:



In order for our vocational agriculture classes to truly be successful we must have all three of the above state components. Classroom instruction gives the students the knowledge and background information needed to begin working. SOEP gives the students the "hands-on" experience of actually applying the information presented in the classroom. This "hands-on" experience builds the skills necessary to gain employment. FFA allows opportunity to apply skills in a fun way. It also allows opportunity to gain recognition and develop leadership skills. FFA-SOEP-Classroom Instruction=Total Vocational Agriculture Program. These three parts form a triangle. With one part missing, the triangle falls apart. All students must be involved in the three parts for the program to be a success.

The first two years will be mainly exploratory in nature.

The last two years of vocational agriculture will be directed toward preparation for employment or entrepreneurship (owner-operator) in production agriculture or agri-business.

- C. Explain the scope and sequence of the four year unit outline with emphasis on what students will learn and be able to do.
- D. Concentrate attention on the first year of the program but describe how the total program fits together.
- E. This is a motivational, student recruitment, and student selection effort. Treat it appropriately.
- F. How can a student get enrolled in Vocational Agriculture?
 - 1. Students should have an interest or a career goal in some phase of agriculture.

2. All students taking Vocational Agriculture will be required to have a occupational experience program in agriculture to make practical application of the class instruction. Supervised occupational experience programs can provide additional opportunity to develop responsibility, help establish goals, and set values and ideas for young people. The program will be periodically supervised by the Vocational Agriculture teacher. Examples of good SOEP'S are work experience in agriculture, livestock projects, crops projects and home improvement projects.
3. Each student will keep and maintain accurate records on their own supervised occupational experience program or project. This will teach good money management and decision making skills.
4. Each student will obtain a social security card.
5. All students are strongly urged to join and become a part of the FFA. The FFA will be used in the classroom to interest and involve students.

SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM
POLICY - VOCATIONAL AGRICULTURE DEPARTMENT

III.

A. INTRODUCTION

Due to the many first hand learning experiences each participant receives in planning, budgeting, feeding, managing, raising crops, construction, exhibiting, record keeping, etc., the supervised occupational experiences program (SOEP) is an essential part of the Vocational Agriculture Program.

B. POLICY STATEMENT

1. Each student enrolled in Vocational Agriculture will have an SOEP.(Project)
2. The project should be tailored to fit each student's particular home situation, desires and occupational goals.
3. The student's project is used as a basis for many FFA awards.
Through the FFA she/he can receive recognition by exhibiting livestock and crops at various shows, and also receive awards.
4. All students should have some home improvement project.
5. Production projects, cooperative work experience and supervised laboratory projects are also encouraged.
6. Periodically during the school year the instructor will check each student's project record book to evaluate his/her record keeping skills.
7. Evaluation will be on the following basis:
 1. Individual performance (progress)
 2. Record Keeping skills
 3. Attitude towards the project.
 4. Applicability to student's agricultural occupational goals
8. A long range plan will be completed by the student with the help of the vocational agriculture instructor and their parents. This plan will project a tentative plan of what the student will do to expand and refine the SOEP over the four years of enrollment in vocational agriculture.
9. Periodically during the school year and summer, the instructor will make project visits to the student's home or place of

employment to become familiar with each project, progress, planning and to provide assistance.

10. Satisfactorily meeting the above standards for supervised projects places a big responsibility upon each student in Vocational Agriculture. However, with a positive attitude, parental support, teacher and older student assistance, we seek each student's full cooperation in this important aspect of their Vocational Agriculture training.
11. The following pages contain a handout (SOEP Question & Answer Sheet) which students could have to take home to help explain SOEP to their parents.

SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM (SOEP)
QUESTION AND ANSWER SHEET

A. WHAT IS THE SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM?

The SOEP is an out of class project dealing with agriculture. It is a part of Vocational Agriculture curriculum across the United States.

B. WHAT IS THE PURPOSE OF THE SOEP?

The purpose of the SOEP is to provide actual training and career experiences in agriculture, for students.

C. WHO NEEDS TO HAVE AN SOEP?

Every Vocational Agriculture student must have an SOEP. It is a part of the agriculture class.

D. WHAT TYPES OF SOEP ARE THERE?

There are 5 types of SOEP available:

- a. Agricultural Production projects (ie. crops & livestock projects)
- b. Cooperative Work Experience (a jog in production agriculture or agri-business)
- c. Home Improvement (ie. Fence repair, Landscape improvement)
- d. Supervised Laboratory Experience (ie. manager of school greenhouse or landlab).
- e. Agricultural Services (ie. custom haying or combining)

E. WHAT ARE SOME SPECIFIC SOEP POSSIBILITIES?

There are many SOEP possibilities. Listed below are a few.

- a. Raising a market animal: Beef, Sheep, Swine, etc.
- b. Raising a breeding animal.
- c. Planting a vegetable garden and selling the produce.
- d. Growing a grain crop.
- e. Working for a local farmer, nursery owner, etc.

F. BY WHAT DATE MUST THE SOEP BE STARTED?

All agriculture students must have a workable SOEP plan by January 10. Students will work on SOEP plans in class early in the school year. Normally the student will have actually started the SOEP by this date, however, some crops etc. project may not actually get underway until spring.

G. HOW WILL THE VOCATIONAL AGRICULTURE TEACHER SUPERVISE THE SOEP'S?

The vocational agriculture teacher will visit each student's SOEP during the school year for the purpose of supervision, assistance, and grading.

H. HOW WILL THE SOEP AFFECT VOCATIONAL AGRICULTURE CLASS GRADING?

The SOEP and related record book is worth approximately 10% of the total points possible. Any student without an SOEP (or acceptable plan) by January 10 cannot receive better than a "C" grade for the last two grading periods.

I. WHAT MAKES UP THE SOEP GRADE?

SOEP grading is based on two things:

- a. The student's SOEP record book.
- b. The instructor's visits.

Each student will be given a book in which to keep records on his/her project. A complete and neatly kept record book will receive maximum points.

On the SOEP visit the instructor will look for project management-whether the student is the primary person responsible for the SOEP, how well it is cared for, etc.

**** NOTE:** Projects should be of a type that relates to an agricultural occupational objective for the student. Students at the freshman and sophomore level may be refining agriculture course objectives and thus will be permitted some latitude in selecting their agricultural SOEP. With the instructors assistance, the students will each determine at least tentative agricultural occupational objectives by the beginning of the junior year. At a minimum, the student will indicate "production agriculture" or "agriculturally related business" at the beginning of junior year. The SOEP will

focus on gaining experience along the lines
of this occupational objective.

IV. FFA

A. What about the FFA?

The Future Farmers of America, or FFA as it is commonly called, is an integral part of vocational agriculture. Through the activities of the FFA the in-class instruction can become more meaningful and useful to the students. Therefore, it so strongly urged that all students taking Vocational Agriculture join and participate in the various activities of the FFA.

The largest national student organization in America, made of, by, and for students in vocational agriculture... A chance for you to belong to a group of people who share and actively pursue their interests in the world of agriculture... An opportunity to increase the value of your vocational agriculture program at school by getting involved in agriculture outside of classroom...

That's FFA

THE FUTURE FARMERS OF AMERICA!!!!

*Activities in your FFA

--Field Trips to agricultural areas of interest.

Greenhouses, Feed Lots, Machinery Dealerships, Animal Hospitals. Where would you like to go?

--Contests that give you the chance to learn the best methods of feeding and caring for show animals or for raising crops to show at county fairs, state and even national championships. Complete with other FFA Chapters and states in public speaking, crop & livestock evaluation and mechanics.

--Leadership and self confidence are natural outgrowths of participation in FFA. Members learn to express themselves and organize their group using the same parliamentary procedure that our Congress uses. If leading your group sounds exciting there are lots of opportunities to polish your skills and even contests to complete in to show them off.

--Earn Money and Awards with your chapter or on your own. That S.O.E.P. steer you raise may earn FFA Awards as well as money. There are awards for team projects or for individual ones...Ribbons, pins, plaques, trophies, and purses are presented by the FFA to winning projects and to successful individuals.

--Travel with team members to districts, regional, state, and national contests and conventions. These are exciting opportunities to see new places and meet people. You can really go places in FFA.

--Community Service is a rewarding part of FFA. Find out how much you have to offer.

--Recreation is a big part of FFA. Picnics, Games, Hayrides, Dances....It's up to you what you decide to do. The list of recreations is only limited by your imagination.

What would you like to do?

It's to your advantage to be a part of today's FFA--

As a student, your future in agriculture depends on your experiences today. In the FFA you will be among people who have related goals and educational interests. The more exposure you have to agriculture today the better you will be able to find a satisfying place in the field of agriculture tomorrow. It's always more fun to become involved in your field in the company of others who share your interests. Get involved now. You'll always be glad you did!!

B. EXAMPLE FFA CHAPTER'S CALENDAR OF ACTIVITIES

SEPTEMBER

- Concession Stand
- FFA Meeting
- District Advisors Meeting
- County Fair
- Freshman Meeting
- FFA Creed Speaking Contest
- District Meeting
- State Officers Leadership Tour

OCTOBER

- Dues Deadline
- FFA Parent Potluck
- Concession Stand
- FFA Meeting
- P.I.L.E. Portland
- District Soils Judging Contest

NOVEMBER

- National FFA Convention - Kansas City, Missouri
- FFA Meeting
- Hay Ride
- District Advisors Meeting

DECEMBER

- FFA Meeting
- District Advisors Meeting
- Snow Party

JANUARY

- State Farmer Applications Deadline
- State Farmer Formal Interviews
- FFA Meeting
- District Advisors Meeting
- Chapter Public Speaking Contest

FEBRUARY

- Chapter Proficiency Award Contest
- FFA Meeting
- National Chapter Applications Deadline
- District Leadership Skills Contests
- National FFA Week
- District Proficiency Awards Contest
- Sectional Leadership Skills Contest

MARCH

- Chapter Officer Interviews
- District FFA Meeting
- District Officer Elections
- Chapter Book and Record Book Contest
- COOP Quiz Contest
- FFA Meeting
- State FFA Convention
- Slave Sale

APRIL

- FFA Meeting
- FFA Parent/Member Banquet
- Officer Installation
- Tractor Driving Test
- Shop Skills Contest

MAY

- FFA Meeting
- District FFA Meeting
- Livestock Judging
- Swimming Party
- Graduation

JUNE

- Livestock Shows
- FFA Meeting
- School's Out

JULY

- FFA Meeting

AUGUST

- County Fairs
- Livestock Judging Contests
- State Fair
- Leadership Camp
- State Tractor Driving Contest
- Ag Teachers Picnic

V. REQUIREMENTS FOR AGRICULTURE CLASS NOTEBOOKS

A. Each student will keep a class notebook which is comprehensive, current, and organized in the manner to be described below.

1. A good notebook serves several purposes:
 - a. Record of student's performance in class.
 - b. Reference source at some later date.
 - c. Study materials for class tests.

B. ORGANIZATION

1. Each student will have their Agriculture notebook, (looseleaf, 3 ring binder type) divided into five sections with each section divider marked in an easily noticeable fashion.
 - a. Each notebook shall have the following five sections in this order:
 1. Classroom Notes (in chronillogical order)
 2. Tests (with wrong answers corrected)
 3. Home work and other assignments
 4. SOEP Record Book
2. Each divider will be properly indexed and all materials will be kept in chronological order. Pages will be numbered and units will be listed on a table of contents immediately following each divider.

C. Evaluation of Notebooks

1. Notebooks will be evaluated once each quarter. The evaluation will be worth 100 points and will be based on completeness, organization, content and neatness.
2. A grade sheet will be placed in front of your notebook. This sheet will be used by the instructor for recording your notebook grade and comments on the notebook.
3. Deficiencies noted by the instructor should be corrected as quickly as possible. These items will be checked again the next grading period.
4. You are held responsible for the class notes on the days you are absent regardless of the excuse. It is your personal responsibility to see that any deficiencies caused by absences are made up.
5. You will need to bring a pen or pencil with you every day to class. Special note paper may be made available to you for class work.

VI. Grading

- A. The grading system used in vocational agriculture will be a points system.
- B. Each assignment will be given a specific number of points (ie. tests, homework, study guides, charts, SOEP records, lab activities and/or projects, notebooks, etc.)
- C. At each nine week grading period the total number of points possible will be added. Grades will be determined on the basis of a percentage of the total possible.

90% +	= A
80-89%	= B
70-79%	= C
60-69%	= D
0-59%	= F

VII. DISCIPLINE AND MANAGEMENT SUGGESTIONS

- A. Classroom control is a prerequisite to classroom learning and many times the key to control and discipline is good classroom organization and management. Achievement is greatly increased for students who are provided with learning experiences in a well disciplined and well organized atmosphere. Those who are not disciplined waste their own individual opportunities and make learning difficult for others. Positive discipline and classroom control and management can only result through joint effort upon the part of the teacher and student.

Organization

- Set classroom climate by how students enter and leave the classroom.
- Begin class promptly and with real enthusiasm. Use an attention getter or interest approach to motivate them.
- Have a routine in all classroom procedures to give security and establish precedents and policies.

Policies and standards

- Let student help set policies
- Keep rules short and simple and adhere to them.
- Develop room standards of behavior.
- Carefully observe all rules expected of the class.
- Use lesson plans that will not be upset by restlessness at such times as before vacation.
- Make assignments clear.
- Be sure class members understand what they are to do. Check to see that directions are really clear.
- Hold every member of the class responsible for knowledge of each concept.
- Grade in terms of achievement of specified lesson/unit objectives.

Personal qualities

- Learn student's names quickly.
- Be friendly, smile and greet students by name.
- Develop a sense of humor which is the ability to have real fun and to laugh at

anything truly humorous.

- Let students know you are capable of laughing with them and at yourself.
- Use your voice to advantage by keeping it rich and calm and never speak over a noisy situation.
- Keep your voice audible but quiet, firm and low-pitched.
- Be impartial and fair. Do not play favorites or hold grudges.

Physical atmosphere

- See to it that ventilation and air circulation and lighting are good.
- Strive to keep the room pleasant and attractive.
- Use student activity, discussion and exhibits to create interest.
- Keep classroom orderly by sharing house-keeping responsibilities with students.
- Have supplies and equipment conveniently located.
- Have a place for everything and insist that items be kept in the proper place.

Classroom management

- Keep students busy by providing a full period of work.
- Be prepared; have alternate plans. Plan so students will have enough work all period, yet not frustrated by undue pressure.
- See that the class is busy before meeting the needs of the few.
- Know what each student is doing at all times.
- Divide large classes into smaller work and study groups.
- Avoid interruptions when students are working on a project.

Know your students

- Discover student interests and special activities.
- Spread responsibility and give each a chance to gain recognition in a positive way.
- Try to find the strong points of the behavior problem child. Help him to achieve.

- Gear teaching experiences to the interests and abilities of the students in class.
- Accept behavior for what it is and what it is trying to achieve. Try to fill the student's need another way so that a child will not have to use unacceptable behavior to gain his ends.
- Know your parents and the community.
- Study the seating of students carefully with an eye to possible necessary changes.
- Note acceptance of individuals by classmates.

Discipline ideas

- Be confident. Do not ignore small things. Be aware of them, and, if possible, correct offenders with quiet signals.
- Reprimand in private and not in front of the class.
- Try to handle your own classroom discipline before asking administrative assistance.
- Be consistent!
- Do not let discipline problems drag out. See what needs to be done and take the necessary action.
- Act after thinking through the consequences rather than threaten things that cannot be carried out.
- Be self-controlled.
- Do not argue! Discuss but do not over-discuss.
- Do not create situations which encourage students to challenge your authority.
- Do not threaten and make "deals" to gain control.
- Listen to the student's side of any troublesome situation.
- Do not be afraid to stand your ground if behavior is not acceptable.
- Use common sense, have confidence in yourself and trust your judgement.

In Summary

Look at your own self in regard to:

- Self-confidence
- Voice

- Enthusiasm
 - Sense of humor
 - Personal appearance
 - Fairness
 - Optimism
 - Promptness
 - Manners
 - Attitude
 - Understanding
 - Values
- Remember that behavior is caused, so work on the causes as well as the behavior.
- Work with parents and community and not by yourself.
- Do not expect change all at once as change takes time.
- Constantly re-evaluate your classroom techniques and look for new methods.
- Do your best! No one asks more!

Suggested example of a classroom control plan which could be a hand out for students follows (on the next page).

Caution: If you don't intend to comply completely and consistently with the suggestions on the handout - make up a handout of your own which you can enforce consistently. Share and agree on this plan with your administrator and with the students in your class.

THE CLASSROOM PLAN

GENERAL CONSIDERATIONS:

The most important mission of a teacher is to teach. Therefore, no student will be allowed to engage in activities during class that limit the educational process in any way.

To facilitate an optimum atmosphere for learning, the following classroom rules will be in effect:

1. Follow directions the first time.
2. No more than one speaker in the room at a time.
3. Be in your seat when the bell rings.
4. Ask permission to leave your seat.

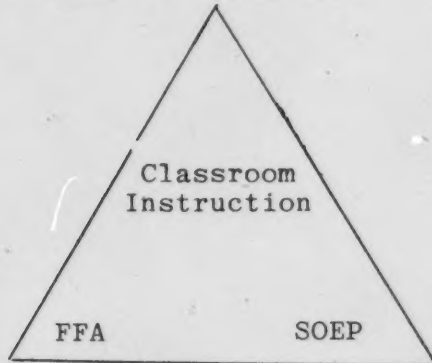
Should these rules be broken at any time, the following steps will be implemented:

1. The offending student's name will be written on the chalkboard as a warning. It will remain there the rest of the period.
2. Should the student continue to break classroom rules, consecutive checkmarks will be placed behind the name.
 - a) One check gives the student the choice of these three options:
 - 1) twenty pushups, done at the end of the class period
 - 2) a one-page report on an agricultural subject, due the next day
 - 3) ten minutes sitting quietly at a desk after school
 - b) Two checks mean:
 - 1) forty pushups, or
 - 2) a two-page report, or
 - 3) twenty minutes after school
 - c) Three checks mean:
 - 1) sixty pushups, or
 - 2) a three-page report, or
 - 3) thirty minutes after school
 - 4) an automatic phone call by the instructor to the student's parents
 - d) Four checks earn an immediate trip to the Vice Principal, as well as one of the choices listed in step three.
3. Any student who has not completed his/her assigned choice by the beginning of the next day's class will not be admitted to class until the choice is completed.

4. Any student causing a severe classroom disruption will be sent immediately to the Vice Principal.

VIII. Total Program Concept - Summary

- A. Draw summary from students.
- B. This vocational agriculture program has three parts (components)



In order to maximize the value of your election of vocational agriculture you should participate in the entire program not just the classroom instruction.

- 1. Classroom instruction accomplishes:
 - a. Presentation of new information about agriculture in:
 - a. Soil Science
 - b. Animal Science
 - c. Plant Science (Crops Horticulture)
 - d. Agricultural Economics
 - e. Agricultural Mechanics
 - f. Leadership Development
- 2. SOEP accomplishes:
 - a. On-site job experience.
 - b. In-depth specialized technical agriculture learning.
 - c. Specialization in one phase of agriculture.
 - d. Development of working attitudes and habits.
- 3. FFA accomplished:
 - a. Refinement and extension of classroom information.
 - b. Travel and social experiences with agricultural industry.
 - c. Development of verbal ability
 - d. Refinement of leadership skills.
 - e. Community consciousness.

I. Tractor and Equipment Operation Unit

- A. The most appropriate tractor and equipment operation instructional materials are copyrighted materials and therefore are not included in this curriculum guide. They must be purchased separately and the name and address for those materials are listed below:

Title: "Safe Operation of Agricultural Equipment"

1. Student Manual - purchase one for each student in class.
2. Instructors Manual - purchase one for the instructor.
3. These instructional materials are available from:

Hobar Publications
1305 Tiller Lane
St. Paul, Mn. 55112

- B. This instructional units prime objective is to teach safe operation of tractors - it is not a complete implements unit. Instruction in operation adjustment and calibration of tillage equipment, planting and spraying equipment and harvest equipment is contained in AgIII and AgIV curriculum guides.

- C. Included here-in is a copy of the Oregon State Fair "Farm Machinery Operations Contest" manual.

1. The manual enclosed was used at the 1980 State Fair.
2. Current copies may be secured each fall from:

Gordan Galbraith
700 Pringle Parkway SE
Salem, Or. 97310

3. The Oregon "Farm Machinery Operations Contest" manual contains:

- a. Course layouts.
- b. Score cards.
- c. Sample questions for written tests.

These items can be used to develop a chapter or district contest. They could also be used directly in the Tractor Driving instructional unit to improve and/or localize instruction.

- D. Suggestions for completing the driving part of the course. Vocational Agriculture teachers of Oregon are currently using the following as means of completing the driving section of the course to reduce the amount

of time wasted by students standing and watching while someone else drives:

1. Schedule students in one at a time to drive during the vocational agriculture teachers preparation period.
 2. Schedule local farmers or alumni to help with student driving activities during the school day (all periods).
 3. Schedule local farmers, Vocational Agriculture teacher and all students on one or two Saturdays.
 4. Schedule joint FFA - 4H Tractor club certification day on one or two Saturdays.
 5. Utilize responsible senior students as teaching aids.
- * Note: Which ever method is used clear all activities through the school districts administrative office and be sure that school district insurance covers the students and teaching assistants during the driving activities.

FFA

PROGRAM
GUIDE

August 26, 1980
Oregon State Fair

Name

Address

Chapter

Test Score

Operating Score

Total Score



Sponsored By
Oregon Farm Bureau
Young Farmer & Rancher Committee

In The Interest Of

Farm Safety

FFA FARM MACHINERY OPERATORS' CONTEST

Page 1

The Oregon Farm Bureau Young Farmer and Rancher Committee, which is sponsoring the FFA Farm Machinery Operators' Contest will provide trophies and cash awards for the State Contest to be held at the Oregon State Fair.

Eligibility

Participation in the State Contest will be by FFA districts. Each district may enter one contestant for every three chapters or major portion thereof in the district. This is to be done in keeping with details outlined in this publication.

Contestant Eligibility

Members must be at least 15 years of age, have completed at least one year of vocational agriculture, have been enrolled in a vocational agriculture class during the 1979-80 school year and be selected by their district to represent their chapter in the State Contest. They are to be in official FFA dress for the contest. Previous first place winners are not eligible.

How Entries in State Contest are to be Made

Tuesday, noon, August 19, is the deadline for the Chapter and District Entry FMOC Form 1 to be in the State FFA office. FMOC Form 1 is a revision of the previous FMOC Forms 1 and 2. The revised Form consists of Part A and Part B.

Part A: Is to be completed by the Chapter Advisor for each chapter member selected to represent the District in the State Contest. It is to be given to the District Advisor.

Part B: The District Advisor is responsible for completing Part B for each chapter member selected to represent the District and have it in the State office on or before 12:00 noon, Tuesday, August 19.

What Is Included in the Contest - Tuesday, August 26

A written test starting at 8:00 a.m., August 26 just prior to the operation phase of the contest, both to be held on the grass quad in front and west of the FFA building. Contestants are to bring a clip board. The test score will be included with the contestant's operation scores in determining the winners.

The operating phase of this activity will start at 9:00 a.m. and will consist of Tractor Maneuvering, Tractor/Cultivator Operation, Pallet Loading and Tractor Loading as outlined in this FFA Program Guide. Additional copies of the guide may be had on request from the State FFA Office.

Local, County or District Farm Machinery Operators Contest

Chapters are urged to work cooperatively with county Farm Bureau leaders in conducting local contests at county fairs or at other suitable events. These should follow as closely as practical the state contest. It is recognized that local factors may make it necessary to vary local, county, or district contests. It is recommended that district elimination contests be held as early as possible to select members to represent the district in the state contest.

If a district contest cannot be held, the district representatives may be selected in keeping with the wishes of the chapters in the district making sure, however that only those who are well qualified and experienced in operating farm machinery are named.

DISTRICT FFA ADVISOR'S RESPONSIBILITIES

The district FFA advisor is a key individual. It is his responsibility to follow through on this activity. In doing so, he is responsible for:

1. Doing whatever is necessary to have the district represented in the state contest.
2. Securing a completed Part A of FMOC Form 1 for each chapter member selected to represent the district in the State Contest.
3. Completing Part B of the FMOC Form 1 for each member selected to represent the district and have these reach the State office on or before 12:00 noon, August 19, 1980.

NOTE

The deadline of August 19 is to give districts as much time as possible to hold district contests. Three copies of FMOC Form 1 are attached to this publication for your use.

Awards to be presented at FFA Award Programs. Recipients are to be in official dress. Appropriate trophies will be awarded to winners of each event and to the top three contestants in the overall contest. Prize money will also be presented to the top four contestants in the overall contest.

1st	\$20.00	3rd	\$10.00
2nd	\$15.00	4th	\$ 5.00

Ribbons will be provided by the Oregon State Fair for the first ten places.

Scoring

Timekeepers will give warning when one minute is remaining. At the end of the allotted time, scoring will cease and the contestant will continue to the finish line. The judge will note on the score sheet if the contestant has run overtime.

When a contestant exceeds the time limit at a station, 100 points will be added to the highest qualifying score at that station and this is what he will receive for that particular event. The Farm Bureau will provide a timekeeper and a judge to score each driving event. A vocational agriculture superintendent will make the final decision on the interpretation of the rules.

Written Test

The written test will consist of multiple choice questions dealing with safe tractor operation, maintenance, service and information relating to equipment operated or attached to the tractor as published in this book.

Station No. 1TRACTOR MANEUVERINGObjective

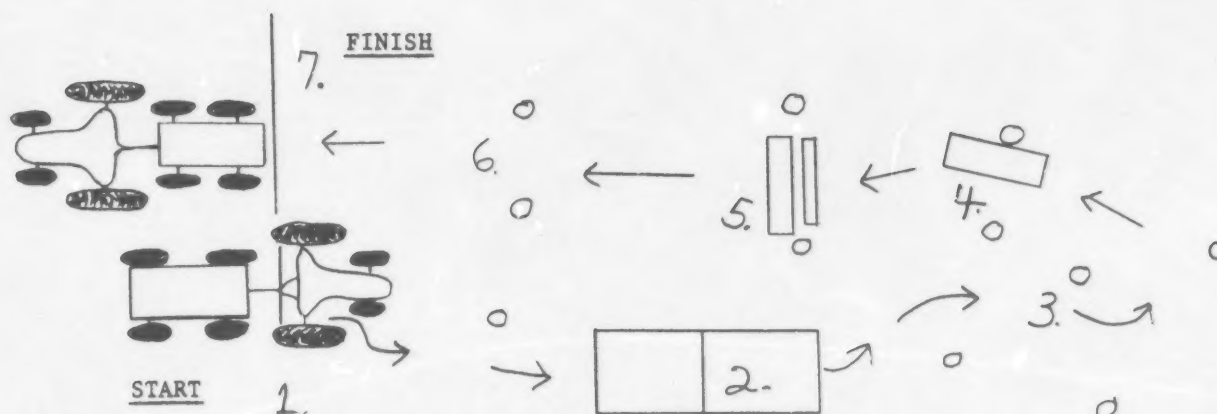
The objective of the tractor maneuvering arena is to test the contestant's skill in driving a tractor with a trailer attached through an obstacle course. Scoring is based upon the starting, stopping, mounting, dismounting, driving over, around and through obstacles in a safe manner and at a reasonable speed.

Rules

1. Time begins when the front wheels of the tractor cross the starting line.
2. A time limit of four (4) minutes. A contestant will be penalized beyond that time as stated on page 2.
3. A one (1) minute warning will be given by the timekeeper.
4. Time ends when the contestant crosses the finish line, sets the brake, idles engine, puts gears in neutral and dismounts from the tractor in a safe manner. (Contestant may be instructed to go through the course a second time providing the size of the area warrants such action).

COURSE LAYOUT

1. starting line
2. simulated hill
3. serpentine gates
4. simulated side hill
5. road bumps
6. narrow gate (3" each side)
7. finish line



TRACTOR MANEUVERING SCORE CARD

1. Time (stopwatch)	<u>POINTS OFF</u>	<u>TOTAL POINTS OFF</u>
_____ Minutes _____ Seconds Total Seconds _____	_____ x 1/2 = _____	
2. Times shifted in order to change travel direction (not including first shift).	_____ x 10 = _____	
3. Markers scraped (number of times).	_____ x 40 = _____	
4. Markers moved, upset or missed (number of times).	_____ x 50 = _____	
5. Killed engine (number of times).	_____ x 10 = _____	
6. Grated gears (number of times).	_____ x 10 = _____	
7. Fouled implement (number of times).	_____ x 10 = _____	
8. Rough clutch engagement (number of times).	_____ x 10 = _____	
9. Safety:		
a. Not setting brakes b. Spinning rear wheels c. Skidding front wheels d. High speed e. Unsafe dismount f. Failure to release parking brake	_____ x 100 = _____	

TOTAL SCORE _____

Station No. 2TRACTOR LOADINGObjective

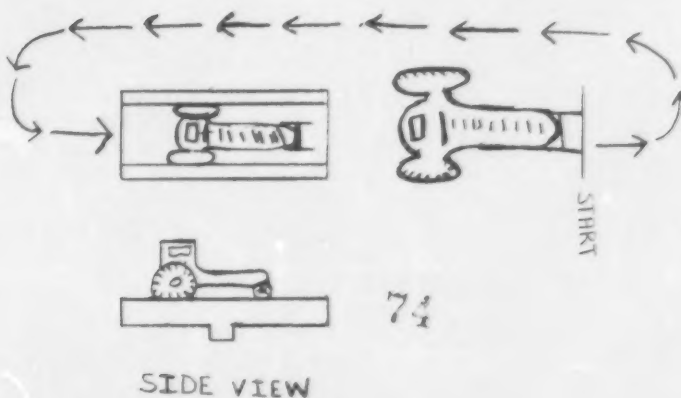
The objective of the tractor loading is to demonstrate the skill and safe operation of loading a tractor on a simulated tilt bed trailer. The contestant must balance the tractor on a platform supported by an 8 x 8 timber.

Rules

1. Time begins when the contestant's front wheels cross the starting line.
2. The contestant circles and drives forward onto the platform and balances the tractor. Contestant may ask the judge for an over-center weight check while the time is still running.
3. Time stops when the contestant has balanced tractor and turned off ignition and remains seated. No additional attempts to balance tractor after engine has once been turned off.
4. A time limit of four (4) minutes. Contestant will be penalized beyond that time as outlined on page two and/or if the tractor is off balance more than 200 pounds (measured with a hand scale from the end over-balanced).
5. A one (1) minute warning will be given by the timekeeper.
6. After tractor has been balanced, set brake and turn off ignition.

COURSE LAYOUT

(subject to change)



TRACTOR LOADING SCORE CARD

1. Time (stopwatch)

_____ Minutes _____ Seconds

POINTS
OFF

TOTAL POINTS
OFF

Total Seconds _____ x 1/2 = _____

2. Number of times shifted in order to
change travel direction (not including
first shift).

_____ x 10 = _____

3. Killed engine (number of times).

_____ x 40 = _____

4. Grated gears (number of times).

_____ x 10 = _____

5. Fouled implement (number of times).

_____ x 40 = _____

6. Rough clutch or slipping clutch
excessively (number of times).

_____ x 10 = _____

7. Number of pounds off center
(number of pounds).

_____ x 2 = _____

8. Not releasing park brake.

_____ x 5 = _____

9. Safety:

- a. Not setting brakes
- b. Spinning rear wheels
- c. Skidding front end
- d. High speed
- e. Unsafe dismount
- f. Failure to release parking brake

_____ x 100 = _____

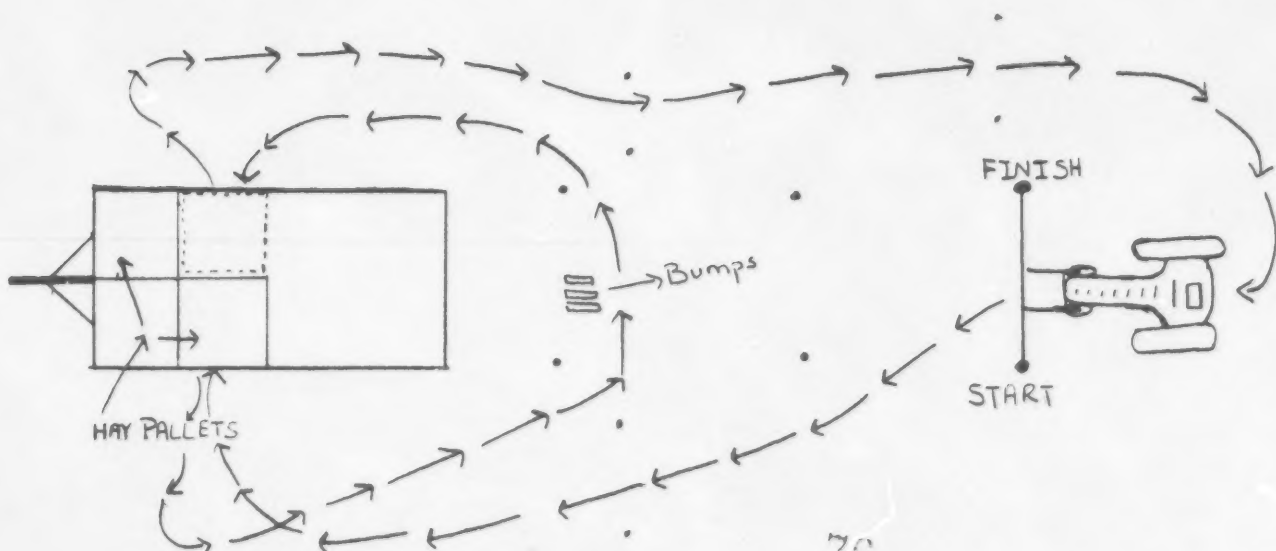
TOTAL SCORE _____

Station No. 3PALLET LOADINGObjective

The objective of the pallet loading contest is to test the contestant's coordination, skill, accuracy and safe operating abilities while loading a hay pallet from one side of the trailer to the other. Contestants will drive over a simulated bump with one set of wheels.

Rules

1. Time begins when front wheels cross the starting line.
2. The contestant proceeds through course as marked with no assistance in loading pallets.
3. Time ends when operator's feet touch ground behind finish line after having properly shut down tractor.
4. Accuracy will be measured by the inches off square on the trailer and the amount of disturbed or out of line hay bales.
5. A time limit of four (4) minutes (unless changed by officials at the contest).
6. A one (1) minute warning will be given by the timekeeper.

COURSE LAYOUT

PALLET LOADING SCORE CARD

	<u>POINTS OFF</u>	<u>TOTAL POINTS OFF</u>
1. Time (stopwatch)		
_____ Minutes _____ Seconds Total Seconds _____	_____ x 1/2 =	_____
2. Times shifted at trailer above four (4) times (4 shifts required).	_____ x 10 =	_____
3. Engine stalled (number of times).	_____ x 10 =	_____
4. Rough clutch (number of times).	_____ x 10 =	_____
5. Grated gears (number of times).	_____ x 10 =	_____
6. Bales dropped.	_____ x 40 =	_____
7. Safety		
a. Not setting brake b. Spinning rear wheels c. Skidding front wheels d. High speed e. Unsafe dismount f. Other	_____ x 100 =	_____
8. Measurements		
a. Front right side of pallet 1. inches of square 2. inches too far back or too close to edge	_____ x 20 = _____ x 20 =	_____ _____
b. Front left side of pallet 1. inches of square 2. inches too far back or too close to edge 3. Bales out of line	_____ x 20 = _____ x 20 = _____ x 20 =	_____ _____ _____

TOTAL SCORE _____

TRACTOR/CULTIVATOR SCORE CARD

1. Time (stopwatch)	POINTS OFF	TOTAL POINTS OFF
_____ Minutes _____ Seconds		
Total Seconds _____	_____ x 1/2 =	_____
2. Number times shifted to change direction.	_____ x 5 =	_____
3. Number of moved markers.	_____ x 5 =	_____
4. Number of markers knocked down.	_____ x 5 =	_____
5. Killed engine (number of times)	_____ x 5 =	_____
6. Grated gears (number of times)	_____ x 5 =	_____
7. Riding clutch	_____ x 10 =	_____
8. Safety		
a. Too fast		
b. Fail to improperly shut down tractor	_____ x 100 =	_____

TOTAL SCORE _____

NAME _____ NO. ASSIGNED _____
ADDRESS _____ YEAR IN SCHOOL _____
SCHOOL _____ AG PROJECT _____

"SAMPLE" QUESTIONS ON SAFE OPERATION OF FARM MACHINERY

1. Exhaust gases are deadly poisonous because they contain (a) carbon monoxide, (b) carbon dioxide, (c) hydrogen sulfide, (d) argon.
2. When speed is doubled, the chance of an upset is (a) doubled, (b) three times as great, (c) four times as great, (d) the same.
3. It takes half a second for a tractor accident to happen. In any emergency it may take you (a) 1/10 second, (b) one second or more, (c) 1/2 second, (d) 3/4 second to make the proper reaction to avoid the accident.
4. Being a safe operator is mostly a matter of (a) pure chance, (b) thinking ahead and avoiding accident situations, (c) skill and luck, (d) none of these.
5. Operation of a modern tractor requires use of (a) both hands and both feet, (b) both hands and the left foot, (c) both hands, both feet and your head, (d) either hand and both feet.
6. The liquid in a battery is a solution of water and (a) hydrochloric acid, (b) sulfuric acid, (c) nitric acid, (d) acetic acid.
7. Tractor tire slippage can be reduced by (a) increasing the air pressure, (b) increasing the engine speed, (c) adding weights to rear wheels, (d) decreasing the air pressure.
8. The proper horizontal distance between the end of the PTO shaft and the hitch point on the drawbar for operating the PTO at 1,000 RPM is (a) 14 inches, (b) 16 inches, (c) 10 inches, (d) 8 inches.
9. A brake on each wheel assists in turning. When making a short turn apply the brake (a) suddenly, (b) lightly, (c) gradually after reducing speed, (d) hard after reducing speed.
10. If it is necessary to tow a tractor a short distance along the highway it should be towed at (a) a very slow speed, (b) ordinary tractor operating speed, (c) high speed in order to get it off the road as quickly as possible, (d) any of the above is satisfactory.
11. It has been estimated that (a) 50, (b) 30, (c) over 80, (d) 10, percent of accidents are caused by operator error.
12. On the basis of the accident rate per man-hour, it is safer to (a) work in a factory, (b) work on a farm, (c) work in an office, (d) work in a mine.
13. The ideal way to attach an implement is to have its center of pull fall (a) directly behind, (b) slightly to the right of, (c) slightly to the left of, (d) any of the above, the center of the tractor.
14. When going down hill the tractor should be (a) placed in high gear, (b) placed in low gear, (c) neutral, (d) middle gear.

15. When working on slopes, near ditches or on rough uneven ground, tractor should be operated (a) at same speed as on level ground, (b) at faster speed than on level ground, (c) at slower speed than when working on level ground, (d) any of the above.
16. When operating a tractor on a highway, the tractor should be provided only with (a) lights and SMV emblem, (b) warning flags, (c) reflectors, lights, warning flags and SMV emblem, (d) equipment required by state law.
17. Extra riders are (a) always, (b) sometimes, (c) never, permitted on a tractor.
18. If you apply only one brake while traveling at high speed with no load, you will probably (a) kill the engine, (b) upset the tractor, (c) skid sideways.
19. Raising the drawbar height (a) increases, (b) decreases, (c) has no effect, on the chance of a backward upset.
20. It is possible to ruin an engine in (a) one hour, (b) one day, (c) one week, (d) one month, by operating it with the air cleaner out of order.
21. A tractor with a wide front end is (a) more, (b) less, (c) no difference, likely to tip than a tricycle type tractor.
22. When getting ready to operate power-driven equipment, the first step is to (a) start it up and see if it still runs, (b) be sure all of the shields and guards are in place, (c) check the speed of the PTO.
23. Safe operation of farm machinery is (a) impossible, (b) a matter of pure chance, (c) learning and practicing safe procedures at all times.
24. When refueling a tractor it is permissible to (a) have the motor running, (b) shut off motor first, (c) either of the above.
25. When cranking tractor, crank (a) should be spun to insure quick starting, (b) limited to quarter turns of crank, (c) limited to half turns of crank.
26. When operating a tractor on highway, the tractor should be driven in (a) normal traffic lane, (b) road shoulder, (c) either of above.
27. When you apply the brake to only one wheel when tractor is traveling at high speed with a load you are likely to (a) upset, (b) find the brake has no effect, (c) jackknife into the load.
28. It is safe to hitch to your tractor (a) anywhere on the back end, (b) to the tractor hitch only.
29. Sparks in exhaust gases (a) are, (b) are not, a fire hazard.
30. (a) All, (b) Some, Tractors can be shifted from one gear to another without using the clutch.
31. (a) One, (b) Both, of the brakes should be used to make an emergency stop.
32. It is important from a safety standpoint to have both brake pedals (a) adjusted for different pressures, (b) adjusted so pressure is applied evenly when the pedals are locked together.

33. The liquid in a battery (a) will, (b) will not, be dangerous if spilled accidentally.
34. Removing a radiator cap suddenly from a pressure cooling system (a) is, (b) is not, dangerous.
35. A loose or broken sparkplug wire (a) can, (b) cannot, cause a fire.
36. When driving a tractor downhill, make certain the clutch is (a) engaged, (b) disengaged.
37. When pulling a heavy load up a slope, keep the hitch (a) as low as possible, (b) as high as possible.
38. It (a) is, (b) is not, permissible to refuel a hot engine.
39. When hooking up implements, tractor power (a) should, (b) should not, be shut off.
40. A modern tractor is about (a) 5, (b) 50, (c) 500, (d) 5,000 times more powerful than the average man.
41. The main purpose of brakes on a tractor is (a) to help make short turns in the field, (b) to make emergency stops, (c) parking the tractor, (d) all of the above.
42. When climbing a very steep grade, tractor should be driven as (a) fast as possible, (b) backed up the grade.
43. When working hilly or rough ground, wheels on the tractor should be set (a) as wide as possible, (b) as narrow as possible.
44. When tractor is mired in muddy ground and you are unable to back out, you should (a) chain blocks to drive wheels, (b) get someone to pull you out.
45. When starting a tractor it is safe procedure to determine that gears (a) are, (b) are not, in neutral position.
46. Before hooking up implements to tractor it is advisable to (a) shut off tractor power, (b) leave tractor motor running.
47. It is (a) permitted, (b) not permitted, to operate a tractor in a closed building.
48. For better pulling up grades, weights should be added to (a) the front wheels, (b) the rear wheels.
49. A fire extinguisher of the (a) carbon tetrachloride type, (b) dry chemical or carbon dioxide type, should be mounted on the tractor.
50. It is better to (a) back out, (b) drive out, of a ditch when the rear wheels start to spin.
51. When starting self-propelled farm machinery it is safe procedure to determine that gears (a) are, (b) are not, in a neutral position.

52. If equipment is not provided with shields and guards over power shafts and drive mechanisms it is (a) alright to operate the machine, (b) not alright to operate the machine.
53. It is (a) permitted, (b) not permitted, to unclog a corn harvester with a wooden stick.
54. Farm machinery provided with the proper guards and shields is (a) completely safe, (b) never completely safe.
55. When operating machinery on rough, uneven ground (a) maintain normal speed, (b) reduce speed.
56. When handling the cutter bar on farm machinery it is (a) permitted to leave tractor engine running, (b) necessary to shut off tractor motor.
57. When servicing or adjusting the hay baler it is (a) sufficient to disengage all power and shut off engine, (b) wait until baler flywheel has stopped rotating.
58. Twine or wire (a) may be pulled or removed from the bale case or knotted when the machine is running, (b) may not be pulled or removed when the machine is running.
59. When working on the knives of a hay baler it is (a) permissible to move the flywheel (b) not permissible to move the flywheel.
60. On forage harvesters it is (a) permitted, (b) not permitted to open auger or cutterhead doors while cutterhead is operating.
61. It is (a) permitted, (b) not permitted, to get in a forage box wagon while it is operating.
62. Belts or chains (a) may, (b) may not, be put on or removed while the pulley or gear is in motion.
63. To reduce tipping hazards, rear wheels on equipment should be (a) as close together as possible, (b) as wide apart as possible.
64. To reduce fire hazard on farm machinery (a) metal sediment bowls, (b) glass sediment bowls, should be used on the engines.
65. All controls should be (a) in neutral, (b) in gear, before turning on the ignition key.
66. When collisions involving farm equipment and other vehicles occur, the person on the farm equipment (a) is, (b) is not, most likely to be killed or injured.
67. When descending a sharp grade, equipment should be slowed by (a) braking, (b) keeping implement in gear.
68. Rear view mirrors (a) are, (b) are not, recommended for farm equipment moving on the highway.
69. When hitching wagons to a tractor for road operation (a) use a safety hitch pin and a safety chain, (b) use a safety hitch pin only, (c) use a safety chain only.

70. A spring release is used on mowing machines to (a) allow cutter bar to swing back when striking an object, (b) allow power to be thrown into gear without slipping, (c) brush trash off the cutter bar.
71. The principal cause of accidents involving farm machinery is (a) faulty equipment, (b) operator error.
72. A long experienced farm machinery operator (a) does, (b) does not, have to be concerned about safety precautions.
73. (a) It is advisable, (b) It is not advisable, to use a wood block to prevent the cutterhead of a forage harvester from turning when adjusting the knives.
74. Young people have quick reactions. It is (a) safe, (b) not safe, for them to unclog a corn harvester while the power is on.
75. When making turns near ditches, gullies or fences it is advisable to (a) speed up the machine to get away from the danger area as soon as possible, (b) slow the machine down to make the turn.
76. Before leaving the tractor seat to adjust or repair any equipment (a) shut off the tractor, (b) disengage the PTO, (c) shut off the tractor and disengage the PTO.
77. The danger spots in a corn harvester are (a) snapping rolls, (b) stalk ejectors, (c) husking rolls and snapping rolls, (d) chains and elevators, (e) all of these.
78. Adequate clothing (a) is, (b) is not, an important safety item for farm machinery operators.
79. Having brakes on a towed wagon (a) is not, (b) is, important as long as the towing tractor brakes are in good condition.
80. In hot weather you should drink plenty of water and take extra salt (a) because you are thirsty, (b) to make up for perspiration losses.
81. Overloading a forage harvester will (a) get the job done faster, (b) cause the machine to clog.
82. Tractors hauling a rotary cutter can (a) safely make short turns, (b) cannot make short turns safely.
83. (a) It is, (b) It is not, advisable to equip exhaust pipes from machinery engines with a non-spark screen to avoid fire.
84. Older machines that were manufactured without safety guards and shields (a) need them, (b) do not need them.
85. Power-take-offs are provided with shields to (a) protect them from dirt and dust, (b) protect the operator.
86. Small children (a) should, (b) should not be permitted around farm machinery.

87. When hitching implements or farm wagons to a tractor you should (a) straddle the pole, (b) stand to one side of the pole.
88. When performing the hitching operation you should (a) lift with your leg muscles, (b) lift with your back muscles.
89. When hand cranking farm equipment engines the crank should (a) be spun around to start the engine rapidly, (b) only be pulled up in quarter or half turns.
90. The crank handle should be held with fingers and thumb on (a) same side of crank handle, (b) thumb on opposite side of handle from fingers.
91. Engines should be cranked with the (a) equipment in gear, (b) equipment in neutral.
92. After unclogging a hay baler, the operator should (a) stand close to the machinery to see that it will operate properly, (b) stand clear, (c) should be on the tractor seat before putting it back in operation.

QUESTIONS 93 - 102 - CIRCLE 2 ANSWERS TO EACH QUESTION

93. A puncture wound can be dangerous because (a) it will leave a deep scar, (b) it may contain embedded foreign material, (c) it will always bleed excessively, (d) tetanus may develop.
94. A thermal burn should be (a) immersed in cold water, (b) covered with any greasy substance, (c) dressed to seal out air, (d) left exposed to the air.
95. Contact with spray chemicals, chemicals should (a) be washed thoroughly with running water, (b) covered to exclude air, (c) a good burn salve applied, (d) container checked for anti-cote.
96. For fertilizer or spray in the eyes, you should (a) immediately cover both eyes, (b) put under running water, (c) make contact with doctor and follow his directions, (d) use gauze to remove from eye.
97. A severe head wound should (a) be well padded to absorb bleeding, (b) checked by a doctor, (c) patient made to lie flat, (d) allow victim to walk for help.
98. If a person has been caught in a power-take-off, (a) stop the motor, (b) apply tourniquet to stop bleeding, (c) reverse motor, (d) try to remove victim.
99. For a severe cut on the arm you should (a) apply direct pressure and elevation, (b) put in hot water, (c) put pressure on pressure point on upper arm, (d) bandage immediately.
100. In treating for shock, you should remember (a) to cover to keep warm, (b) to keep victim moving, (c) may occur from any injury, (d) may occur from only a severe head wound.
101. In leg and arm injuries (a) you should move injured part to see if fractured, (b) you should immobilize, (c) only a doctor can tell for sure whether severe sprain or fracture, (d) move to better position to treat.

102. In general (a) a drowning victim should be allowed to go on with work as soon as revived, (b) a compound fracture should first be treated from bleeding, (c) a back injury should not be moved without plenty of help, (d) you should induce vomiting if someone accidentally swallows gasoline.

FARM TRUCK OPERATOR

1. What is the maximum height of a load above ground?
2. If you break down on the highway at night you must put out what devices?
3. When must you have a chauffeur's license?
4. You must have a red flag at least 12" square on any load that extends how far beyond the bed of truck?
5. A good rule of thumb for how fast it is safe to go down hill with a load is?

DUE IN STATE OFFICE BY
12:00 noon, TUESDAY, AUGUST 19

AgI-III-21
FMOC FORM 1
YEAR _____

CHAPTER AND DISTRICT ENTRY
STATE FFA FARM MACHINERY OPERATORS CONTEST

 PART A To be completed by the Chapter Advisor for each chapter member selected to represent the district in the State Contest. It is to be given to the District Advisor, who is responsible for completing Part B and forwarding this form to reach the State Office on or before 12:00 noon, Tuesday, August 19.

SCHOOL _____

NAME OF CONTESTANT _____ AGE _____

YEARS OF VO-AG COMPLETED _____ FFA DEGREE HELD _____

RT., BOX or STREET ADDRESS _____

CITY _____ ZIP _____

PARENT'S NAME _____ TELEPHONE NUMBER _____

This is to certify that the above named individual is eligible to represent our Vocational Agriculture Department in this state activity if he or she is named to represent our district.

Vocational Agriculture Instructor _____ Date _____

=====

 PART B The District Advisor is responsible for completing Part B for each member selected to represent his or her district and have it in the State Office on or before 12:00 noon, Tuesday, August 19.

I certify that the above FFA Member is one of _____ selected to represent our district in the State FFA Farm Machinery Operators Contest.

FFA members from _____ chapters took part in our district contest. Farm Bureau members did/did not cooperate in holding the contest. (Circle One).

If a district contest was not held, indicate below or on the back of this form how the above district representatives were selected.

_____, District FFA Advisor of _____ District

FFA

Future Farmers of America

Instructors Guide:

1. Included in this unit are two different approaches to covering the FFA with freshman vocational agriculture teachers.
2. Pages 3 through 13 include a study guide to the "Student Handbook - FFA". This is a popular reference which is used by many vocational agriculture teachers and the study guide will assist in coverage. Also included is a sample test which could be used with the study guide materials. Teach FFA first then the creed.
3. Page 14 to the end is an optional unit you may consider if you do not have the "Student Handbook - FFA". All materials are presented in this unit to teach the FFA.
4. The FFA also has some excellent additional information in the form of a Leadership Packet which includes:
(a.) Personality Pointers, (b.) Working With Others, (c.) Outstanding Citizenship, (d.) Conducting Meetings, (e.) Money Management, (f.) Improving Communications, (g.) Social Graces, (h.) Effective Committees, (i.) Good Grooming, and (j.) Chapter Membership. These are excellent teaching materials on leadership. They could be used in the classroom, at leadership camps, in individualized instruction for preparation of state officer candidates or chapter representatives to state and/or national conventions.

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Write a short paragraph describing major events in the history of the Future Farmers of America.
2. List the requirements for membership in the FFA.
3. Select from a list the types of memberships in the FFA.
4. Name the official FFA colors.
5. Write the FFA motto.
6. Recite the FFA creed.
7. List the five symbols which make up the FFA emblem and the meaning of each.
8. Select from a list of terms the four degrees of active membership.
9. Name the six main offices of the local chapter and one duty of each.

10. Name the officers of the state association.
11. Identify the symbols of the FFA officers' stations.
12. List four essentials of a good chapter.
13. Select from a list the primary aim of the FFA.
14. List four of the specific purposes of FFA.

Ideas on Motivation

When teaching the FFA unit, motivate students by selling the program and the importance of the greenhand degree. Then, when it's time to learn the creed, sell the fact that the creed is the last step towards getting their degree. Also use the contest as motivation, it's usually good for 5 people or so, and stress the advantages of public speaking.

Start the creed on Friday and offer extra credit for anyone who can say more than the first paragraph on Monday. (the first paragraph is due Monday). The second paragraph is due on Tuesday and extra credit is offered for anything more. The same is continued until Friday when the last paragraph is due.

It has been found that anything over a week on the creed is a waste of time for large classes, small classes should use less time. The students who don't say it after a week are usually not likely to say it at all.

For those students who don't say the creed offer a last minute reprieve (just before initiation) to write an essay on what the creed (each paragraph) means in laymens terms.

Each day after students have said the appropriate paragraph, they memorize the creed in teams of 2. Usually there is enough class time to memorize the next paragraph. After the creed section is done, instructors should have much better luck recruiting creed speakers.

Another motivational method for consideration would be to have last years chapter creed speakers say the creed to the class. Usually the speaker sets a good example to follow and also makes the seemingly "horridus task" look easy.

FFA STUDENT HANDBOOK

Page 1-27

Name _____

Date _____

1. What can the FFA do for you?
 - a. e.
 - b. f.
 - c. g.
 - d. h.
2. What industry has more Americans working for it than any other field of employment?
3. List seven of the major headings of Agricultural careers.
 - a. e.
 - b. f.
 - c. g.
 - d.
4. Who is remembered as the father of the FFA?
5. When and where was the first National Convention held for the FFA?
6. Write out the FFA motto.
7. What are the FFA's colors?
8. What are the 5 symbols in the FFA emblem?
 - a.
 - b.
 - c.
 - d.
 - e.

9. What does each symbol stand for in the FFA emblem?
10. What is the First Degree in the FFA called?
11. What are the four kinds of membership in the FFA?
12. What is the primary aim of the FFA?
13. What are the 12 purposes of the FFA?

FFA Handbook P.P. 28-37

14. What is the official dress for young women?
15. What is the official dress for young men?
16. What three medals can be worn on the FFA jacket?
17. You learn best by _____.
18. How does a Supervised Experience Program benefit you?
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
19. What are the four major areas to obtain an experience program in?
 - a. _____
 - b. _____
 - c. _____
 - d. _____
20. What all does your National FFA dues include for you?
21. Why is the greenhand degree pin bronze?
22. What are the next three degrees in the FFA after greenhand?

FFA HANDBOOK WORKSHEET

Page 39-57

Name _____

1. What is the key to good meetings?
2. What is the general order of business of a meeting? (11)
3. What are the six officers of the FFA?
4. What are the 11 standing committees in the FFA?
5. What are the 4 main objectives of Parliamentary law in a meeting?
6. What are the 3 requirements for a meeting to take place?

Page 79-95

7. Who receives the Star Greenhand award each year?
8. Who receives the Star Chapter Farmer award each year?
9. How does the Star Agribusinessman differ from Star Chapter Farmer award?
10. How many Proficiency awards are there?
11. Winners in the Proficiency Award Programs are selected how?
12. List the different proficiency award areas.

FFA HANDBOOK PAGE 105-135

Name _____

1. List the 13 requirements to receive the chapter farmer degree.
2. What metal is the chapter farmer pin made from?
3. Many FFA chapters have a banquet in which they --
4. What degree must you hold to be a state officer candidate?
5. What is the largest annual student convention in the nation?
6. What is the Food for America activate?
7. What does B.O.A.C. stand for?
8. What two degrees are awarded by the local FFA chapters?
9. What percentage of the state membership may receive the State Farmer degree?
10. Who awards the State Farmer degree?

11. What are the requirements for the State Farmer degree? (8)
12. What percentage of FFA members receive the American Farmer degree?
13. What are the requirements for the American Farmer degree?
14. In what year was the FFA founded?
15. When did the FFA Alumni begin?
16. When and why was the National FFA foundation started?

FFA STUDENT HANDBOOK TEST

Name _____

1. What industry has more Americans working for it than any other field of employment?
2. Write out the FFA motto.
3. What are the 5 symbols in the FFA emblem?
4. What does each symbol stand for in the FFA emblem?
5. What are the four degrees in the FFA called?
6. What is the primary aim of the FFA?
7. What is the key to good meetings?
8. What are the six offices of the FFA?

9. What are the 4 main objectives of Parliamentary law in a meeting?
10. What are the 3 requirements for a meeting to take place?
11. What is a proficiency award in the FFA?
12. Winners in the proficiency award programs are elected how?
13. Many FFA chapters have a banquet in which they ---
14. What is the Food for American activity?
15. What are the two degrees that can be awarded by the local FFA chapter?
16. What percentage of the state membership may receive the State Farmer degree during any given year?

17. What percentage of FFA members receive the American Farmer degree during any given year?
18. In what year was the FFA founded?
19. When the FFA jacket is worn, how is it correctly worn?
20. What three medals can be worn on the FFA jacket?

FFA - Optional Unit

1. The following is an optional unit for FFA instruction. You may use it if you do not have the "Student Handbook - FFA".
2. Material covered here is essentially the same as that material covered in the "Student Handbook - FFA" with the assistance of the study guide.

FFA - THE ORGANIZATION

TEACHING OUTLINE

I. Brief history of the FFA

- A. Organized nationally in 1928 at Kansas City, Missouri
- B. Oregon - The 35th state chartered in 1929
- C. National convention held each November in Kansas City, Missouri
- D. State convention - Held each March
- E. State advisor - Gordon Galbraith
- F. 510,000 members in 8148 chapters throughout 50 states and Puerto Rico
- G. 4,600 members in 104 Oregon Chapters
- H. Admitted young women into the organization in 1969

II. Requirement for membership

- A. 14-21 years of age
- B. Enrolled in vocational agriculture
- C. Be in good standing with local chapter
- D. (Local requirements)

III. Types of membership in the FFA (Page 23, Student Handbook)

- A. Active (See section B, pages 58-59, Official FFA Manual)
- B. Honorary (See section E, page 59, Official FFA Manual)
- C. Alumni (See section C, same as above)
- D. Collegiate (See section D, same as above)

IV. Official FFA colors--National blue and corn gold

V. FFA motto

Learning to do, Doing to learn,
Earning to live, Living to serve

- VI. The FFA creed (To be worked on by students later, is presented for information and continuity here).

I believe in the future of farming, with a faith born not of words but of deeds--achievements won by the present and past generations of agriculturists; in the promise of better days through better ways, even as the better things we now enjoy have come to us from the struggles of former years.

I believe that to live and work on a good farm, or to be engaged in other agricultural pursuit, is pleasant as well as challenging; for I know the joys and discomforts of agricultural life and hold an inborn fondness for those associations which, even in hours of discouragement, I cannot deny.

I believe in leadership from ourselves and respect from others. I believe in my own ability to work efficiently and think clearly, with such knowledge and skill as I can secure, and in the ability of progressive agriculturists to serve our own and the public interest in producing and marketing the product of our toil.

I believe in less dependence on begging and more power in bargaining; in the life abundant and enough honest wealth to help make it so--for others as well as myself; in less need for charity and more of it when needed; in being happy myself and playing square with those whose happiness depends upon me.

I believe that rural America can and will hold true to the best traditions of our national life and that I can exert an influence in my home and community which will stand solid for my part in that inspiring task.

The creed was written by E.M. Tiffany, and adopted at the 3rd National Convention of the FFA. Revised at the 38th Convention.

- VII. Symbols of the FFA emblem (Pages 7 & 74, OFFICIAL FFA MANUAL & Page 22 Student Handbook)

- A. Owl--Symbolic of wisdom and knowledge
- B. Plow--Symbolic of labor and tillage of the soil
- C. Rising Sun--Symbolic of a new day (era) in agriculture
- D. Cross-section of the ear of corn--Symbolic of common agricultural interests
- E. American Eagle--Symbolic of the national scope of the organization

- VIII. Degrees of active membership (Page 59, Official FFA Manual & Pages 32, 36, 106-111, 123-129, Student Handbook)

- A. Greenhand

- B. Chapter Farmer
- C. State Farmer
- D. American Farmer

IX. Offices of the local chapter and duties

(Pages 12, 16 Official FFA Manual, 75-77 Student Handbook)

- A. President--Presides over all meetings
- B. Vice-President--Assists president and directs all committee work
- C. Secretary--Keeps minutes of all meetings
- D. Treasurer--Keeps financial records
- E. Reporter--Reports chapter news
- F. Advisor--Advises FFA members on all matters relating to the chapter
- G. Sentinel--Assists president in maintaining order
- H. Historian--Keeps chapter scrapbook
- I. Chaplin--Takes charge of religious exercises during meetings, banquets, or other occasions
- J. Parliamentarian--Informs the members on correct parliamentary procedure

X. State FFA officers (to be completed by teacher)

- A. President--
- B. Vice-President--
- C. Secretary--
- D. Reporter--
- E. Treasurer--
- F. Sentinel--
- G. Advisor

XI. Symbols of FFA officer's station (Transparency 1)

- A. Rising sun--President
- B. Plow--Vice President
- C. Ear of corn--Secretary

- D. Bust of Washington--Treasurer
- E. American Flag--Reporter
- F. Shield of Friendship--Sentinel
- G. Owl--Advisor

XII. Essentials of a good chapter

- A. Knowledge of the FFA on the part of every member
- B. Capable officers and leaders
- C. Responsibilities shared by all members in chapter activities.
- D. A challenging program of activities
- E. Adequate financing for chapter activities
- F. Proper paraphernalia, equipment and records
- G. Well planned, regularly held chapter meetings
- H. Support by school officials and community leaders

XIII. Primary aim of FFA--Development of agricultural leadership, cooperation, and citizenship (Front cover of Official FFA Manual)

XIV. Specific purposes of FFA (Pages 23-27, Student Handbook)

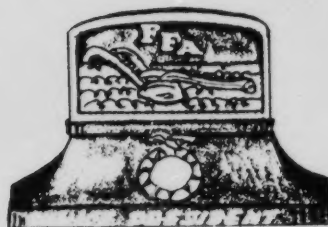
- A. To develop competent, aggressive, rural, and agricultural leadership
- B. To create and nurture love of country life
- C. To strengthen the confidence of farm boys and young men in themselves and their work
- D. To create more interest in the intelligent choice of farming occupations
- E. To encourage members to improve the farm house and its surroundings
- F. To encourage members in the development of individual farming programs and establishment in farming
- G. To participate in worthy undertakings for the improvement of agriculture
- H. To develop character, train for useful citizenship, and foster patriotism
- I. To participate in cooperative effort

- J. To encourage and practice thrift
- K. To encourage improvement in scholarship
- L. To provide and encourage the development of organized rural recreation.

Symbols of Officer's Stations



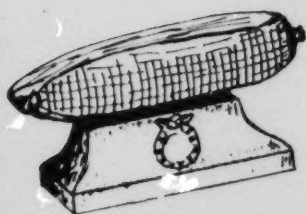
Advisor



Vice-President



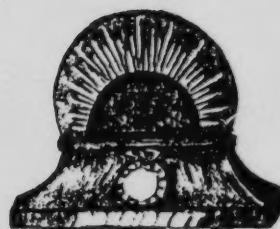
Treasurer



Secretary



Reporter



President



Sentinel

FFA - THE ORGANIZATION

TEST

1. Write a short paragraph describing major events in the history of the Future Farmers of America.

2. List the requirements for membership in the FFA.

- a.
- b.
- c.
- d.

3. Select from the list below the types of membership in the FFA by placing an "X" in the correct blanks.

- ☐ a. Active
- ☐ b. Associate
- ☐ c. Collegiate
- ☐ d. Inactive
- ☐ e. Honorary
- ☐ f. Regular
- ☐ g. Chapter Farmer
- ☐ h. Alumni

4. The official FFA colors are _____ and _____.

5. Write the FFA motto.

6. Recite the FFA creed.

(Note: If this activity has not been accomplished prior to the test, ask the instructor when it should be completed.)

7. List the five symbols which make up the FFA emblem and the meaning of each.

- a.
- b.
- c.
- d.
- e.

8. Select from a list of terms below the four degrees of active membership by placing an "X" in the correct blanks.

- _____ a. Honorary
- _____ b. Chapter Farmer
- _____ c. Alumni
- _____ d. Associate
- _____ e. Greenhand
- _____ f. American Farmer
- _____ g. Regular farmer
- _____ h. State Farmer

9. Name the seven main officers of the local chapter and one duty of each.

- a.
- b.
- c.
- d.
- e.
- f.
- g.

10. Name the following officers of the state association.

- a. President-

- b. Vice-President-
- c. Secretary-
- d. Treasurer-
- e. Reporter-
- f. Sentinel-
- g. Advisor-

11. Identify the FFA officers' symbols from the following diagrams.



a. _____



b. _____



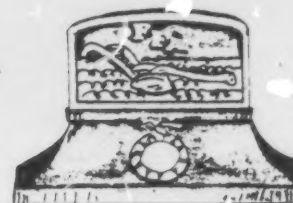
c. _____



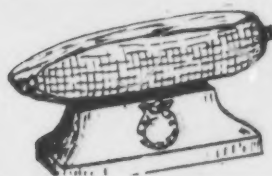
d. _____



e. _____



f. _____



g. _____

12. List four essentials of a good chapter.
 - a.
 - b.
 - c.
 - d.

13. Underline the primary aim of the Future Farmers of America.
 - a. The development of leadership
 - b. The maturing of the individual
 - c. The development of self-confidence
 - d. The development of agricultural leadership, cooperation, and citizenship

14. List four of the specific purposes of FFA.
 - a.
 - b.
 - c.
 - d.

FFA - THE ORGANIZATION

ANSWERS TO TEST

1. Description should include the following
 - a. Organized nationally in 1928 at Kansas City, Missouri
 - b. Oregon has number 35 charter
 - c. National convention held at Kansas City in November annually
 - d. Oregon State convention held in March annually
 - e. State Advisor - Gordon Galbraith
 - f. 510,000 members in 8,148 chapters throughout 50 states and Puerto Rico
 - g. 4600 members in 104 chapters in Oregon
 - h. Admitted girls into the FFA in 1969
2.
 - a. 14-21 years of age
 - b. Enrolled in vocational agriculture
 - c. Be in good standing with local chapter
 - d. (Local requirements)
3. a, c, e, h
4. National blue, corn gold
5. Learning to do,
Doing to learn,
Earning to live,
Living to serve.
6. This should be completed before test time. Evaluated to the satisfaction of the instructor.
7.
 - a. Owl--Symbolic of knowledge and wisdom
 - b. Plow--Symbolic of labor and tillage of soil
 - c. Rising sun--Symbolic of a new day (era) in agriculture

- d. Cross section of ear of corn--Symbolic of common agricultural interests
- e. American Eagle--Symbolic of the national scope of the organization
- 8. b, e, f, h
- 9. a. President--Presides over all meetings
- b. Vice-President-- Assists president and directs all committee work
- c. Secretary--Keeps minutes of all meetings
- d. Treasurer--Keeps financial records
- e. Reporter--Reports chapter news
- f. Sentinel--Assists president in maintaining order
- g. Advisor--Advises FFA members on all matters relating to the chapter
- 10. (To be completed by instructor each year)
- a. President--
- b. Vice-President--
- c. Secretary--
- d. Treasurer--
- e. Advisor--
- f. Sentinel--
- g. Reporter--
- 11. a. Treasurer
- b. Sentinel
- c. Reporter
- d. Advisor
- e. President
- f. Vice-President
- g. Secretary
- 12. Any four of the following
- a. Knowledge of the FFA on the part of every member
- b. Capable officers and leaders

- c. Responsibilities shared by all members in chapter activities
- d. Challenging program of activities
- e. Adequate financing for chapter activities
- f. Proper paraphernalia, equipment, and records
- g. Well planned, regularly held chapter meetings
- h. Support by school officials and community leaders

13. d

14. Any four of the following

- a. To develop competent, aggressive, rural, and agricultural leadership
- b. To create and nurture love of country life
- c. To strengthen the confidence of farm boys and young men in themselves and their work
- d. To create more interest in the intelligent choice of farming occupations
- e. To encourage members to improve the farm house and its surroundings
- f. To encourage members in the development of individual farming programs and establishment in farming
- g. To participate in worthy undertakings for the improvement of agriculture
- h. To develop character, train for useful citizenship, and foster patriotism
- i. To participate in cooperative effort
- j. To encourage and practice thrift
- k. To encourage improvement in scholarships
- l. To provide and encourage the development of organized rural recreational activities

Name _____

Class _____

Activity Sheet

Answer the following questions and list the source and page # for your answer.

I. True and False - Circle the correct answer. If any part of the question is false, the whole question is false.

- | | | | |
|---|---|-----|---|
| T | F | 1. | The National Organization was founded at Kansas City, Mo., November 20, 1928. |
| T | F | 2. | To be a member you do not need to be enrolled in a Vocational Agriculture class. |
| T | F | 3. | There are 50 state associations including Puerto Rico, not including Alaska. |
| T | F | 4. | The FFA is a national organization of boys and girls studying vocational agriculture in high school. |
| T | F | 5. | After you graduate from high school you cannot be an FFA member any longer. |
| T | F | 6. | There are approximately 500,000 FFA members. |
| T | F | 7. | The Future Farmers organization owns its own building, publishes its own magazine, and operates the Future Farmer Supply House. |
| T | F | 8. | The Greenhand receives the bronze pin. |
| T | F | 9. | The plow is the symbol of labor and tillage of the soil. |
| T | F | 10. | The vice-president's symbol is the flag. |
| T | F | 11. | The honorary chapter farmer degree is given on the National level. |
| T | F | 12. | To receive the American Farmer Degree you must have earned \$1,000.00 from your farming project. |
| T | F | 13. | Before receiving the Greenhand Degree you must recite the FFA creed. |
| T | F | 14. | Honorary memberships are given to people who help the FFA. |
| T | F | 15. | The highest degree an FFA member can receive is the State Farmer Degree. |
| T | F | 16. | The advisor is elected by the chapter members. |

II. Completion

1. What are the FFA colors?
A. _____
B. _____
2. List the four degrees of active membership:
A. _____
B. _____
C. _____
D. _____
3. List the six offices and the symbol of each:
A. _____
B. _____
C. _____
D. _____
E. _____
F. _____
4. What is the FFA motto?
5. List three of the symbols found in the FFA emblem.
A. _____
B. _____
C. _____
6. Who can belong to the FFA?
7. Name 2 State officers.
A. _____
B. _____
8. Who is the chapter advisor? _____
9. What public law granted the FFA a federal charter?

10. What abilities did this federal charter give to the FFA?
List 2.
A. _____
B. _____
11. What is the Plow symbolic of?
12. What is the Primary Aim of the FFA?
13. Who gives the Greenhand Degree to the members?
14. List 5 Agricultural Occupations.
A. _____
B. _____
C. _____
D. _____
E. _____
15. Give the Brotherhood Pledge.

List the names of the following chapter, district, and state officers.

President _____
 Vice-President _____
 Secretary _____
 Treasurer _____
 Reporter _____
 Sentinel _____
 Advisor _____
 State President _____
 District President _____
 Chapter Sweetheart _____

DUTIES AND RESPONSIBILITIES OF FFA MEMBERS

Teaching Outline

- I. Order of business for FFA meetings (Page 17, Official FFA Manual, Page 40, Student Handbook)
 - A. Opening ceremony
 - B. Minutes of the previous meeting
 - C. Orders of the day
 - D. Officers' reports
 - E. Reports on chapter program of activities
 - F. Special features
 - G. Unfinished business
 - H. Committees' reports
 1. Standing
 2. Special
 - I. New business
 - J. Degree and installation ceremonies
(NOTE: Used only when new members are initiated, when Greenhands are raised to the Chapter Farmer degree, or when officers are installed.)
 - K. Closing ceremony
 - L. Entertainment, recreation, refreshments
- II. Items that constitute a good FFA meeting
 - A. Effective use of an executive committee to assure careful planning in advance of the meeting time
 - B. Starts and closes on time
 - C. Proceeds according to an established order of business
 - D. Conducted according to accepted parliamentary procedure
 - E. Includes well-prepared committees', secretary's and treasurer's reports

- F. Shows that each officer is familiar with his or her duties and responsibilities
 - G. Commands the interest and attention of all members
 - H. Provides for maximum member participation and develops the cooperative attitude
 - I. Includes business, entertainment features, and refreshments
 - J. Moves along with "snap" thus preventing monotony and the wasting of time
 - K. Proceeds with a minimum of active participation by the Advisor
- III. Location of FFA officers' stations in the meeting room (Transparency 1) (Page 24, Student Handbook)
- IV. Areas covered in program of activities (Page 14, Official FFA Manual, Page 49-53, Student Handbook)
- A. Supervised agricultural occupations experience
 - B. Cooperation
 - C. Community service
 - D. Leadership
 - E. Earning and saving
 - F. Conduct of meetings
 - G. Scholarship
 - H. Recreation
 - I. Public relations
 - J. State and national activities
 - K. Alumni Relations
(NOTE: Chapter executive committee should appoint each person to a committee on the program of activities)
- V. Purposes for which committees are formed
- A. To reach chapter goals
 - 1. Standard chapter award
 - 2. Superior chapter award

3. National chapter award
 - a. Bronze emblem chapter
 - b. Silver emblem chapter
 - c. Gold emblem chapter
 - B. To accomplish specific work assignments
 - C. To deal with specific problems
 - D. To research and make recommendations about new areas of interest
- VI. Proper wear of FFA jacket or blazer (Page 44, Official FFA Manual, Pages 28-29, Student Handbook)
- A. The jacket or blazer should only be worn by persons who are members of the organization
 - B. It should be kept clean and neat at all times
 - C. The jacket should have only a large emblem on the back and a small emblem on the front; the name of the State Association and the name of the local chapter on the back; and the name of the individual and one office or honor on the front
 - D. For the most attractive appearance, the jacket should be worn on official occasions with the zipper fastened to the top. The collar should be turned down and the cuffs in place and buttoned
 - E. The jacket or blazer should be worn by officers and members on all official FFA occasions, as well as other occasions where the chapter is represented. It may be worn to school and other appropriate places
 - F. The jacket or blazer should only be worn to places that are appropriate for members to visit
 - G. The jacket should be worn by contestants in the National Public Speaking Contest, and at other occasions when FFA members are receiving FFA awards
 - H. School letters and insignia of other organizations should not be attached to or worn on the jacket
 - I. The jacket or blazer should not be worn with garments bearing the insignia of other organizations
 - J. When the jacket becomes too faded and worn to wear in public, it should be discarded or the emblems and lettering should be removed

- K. The emblems and lettering should be removed if the jacket or blazer is given or sold to a non-member
- L. A member always acts like a lady or gentleman when wearing the jacket or blazer
- M. Members should refrain from smoking while wearing the FFA jacket or blazer or when officially representing the organization
- N. All chapter degree, officer, and award medals should be worn beneath the name on the right side of the jacket, with the exception that a single State Farmer charm and American Farmer key should be worn above the name or attached to a standard key chain. No more than three medals should be worn on the jacket; these should represent the highest degree earned, the highest office held, and the highest award earned by the member

VII. Code of ethics for FFA members (Page 45, Official FFA Manual, Page 30, Student Handbook)

- A. Dress neatly and appropriately for the occasion
- B. Show respect for the rights of others and be courteous at all times
- C. Be honest and do not take unfair advantage of others
- D. Respect property of others
- E. Refrain from loud, boisterous talk, swearing, and horseplay
- F. Demonstrate sportsmanship in the show ring, judging contests, and meetings
- G. Attend meetings promptly and respect the opinions of others in discussion
- H. Take pride in the FFA organization, activities, farming programs, exhibits, and in the occupation of farming and ranching
- I. Share with others experiences and knowledge gained by attending national and state meetings

VIII. Leadership activities (Page 48, Official FFA Manual, Page 50, Student Handbook)

- A. Provide special training for newly elected officers
- B. Elect auxiliary officers
- C. Conduct chapter public speaking contest

- D. Provide experience in parliamentary procedure
 - E. Provide experience in conducting meetings
 - F. Participate in a chapter leadership training school
 - G. Send members to state and district conventions
 - H. Encourage sending president to FFA National Leadership Conference
 - I. Provide committee work
- (NOTE: Each member should be assigned to a standing committee.)
- J. Assist members to apply for the higher degrees
 - K. Encourage participation in school activities that involve leadership
 - L. Encourage participation in community activities

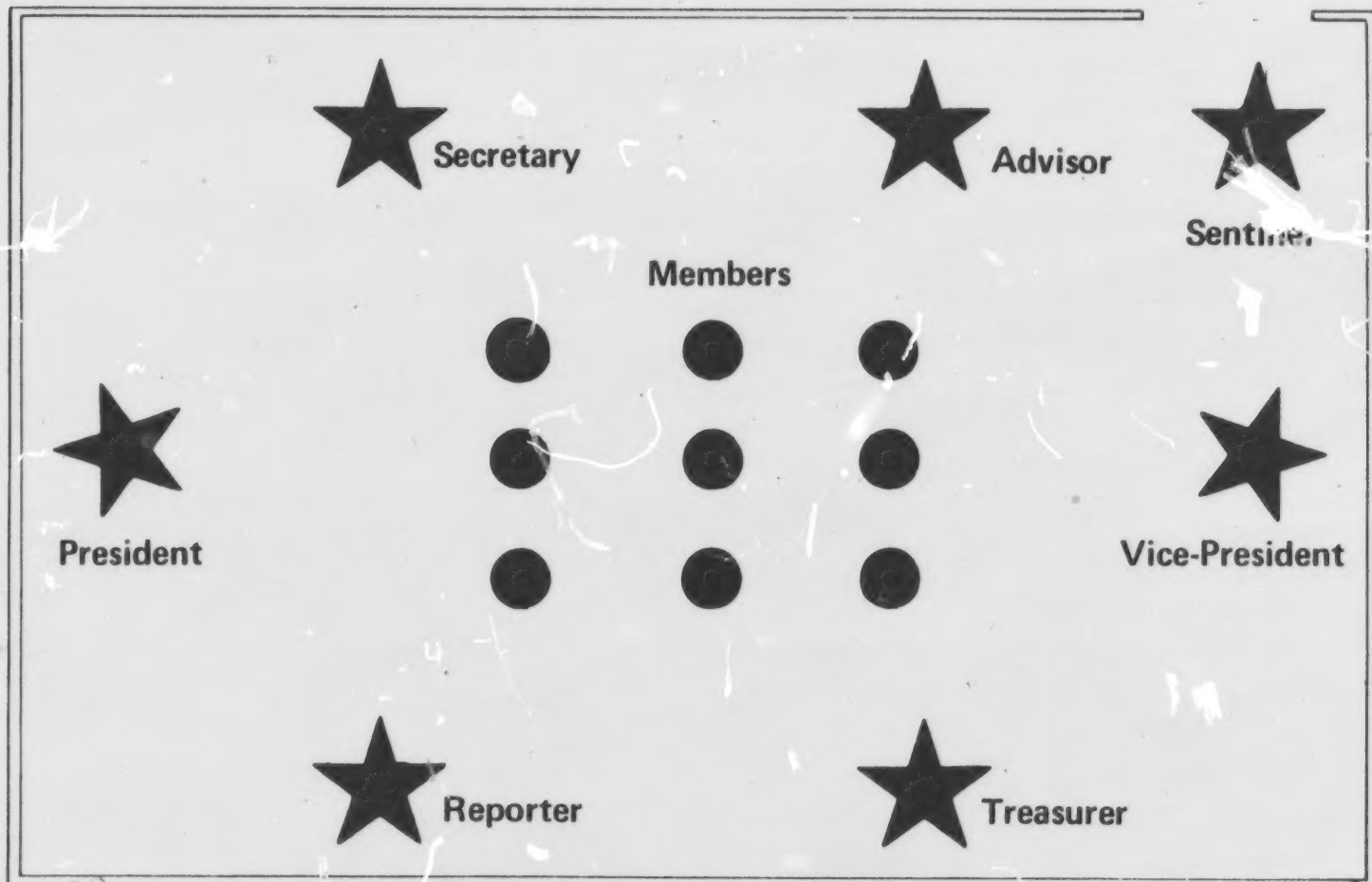
IX. Purposes of Future Farmer Supply Service

- A. Supplies all official FFA merchandise
- B. Insures uniformity in official FFA merchandise
- C. Provides high-quality official merchandise

X. National FFA Week activities

- A. Radio and TV programs
- B. FFA Week articles in newspapers
- C. School assembly
- D. Civic club program
- E. Parent and son banquet
- F. Posters displayed around town
- G. Attend church as a group
- H. Window displays
- I. Others that the chapter approves

Room Arrangement for FFA Meeting



DUTIES AND RESPONSIBILITIES OF TFA MEMBERS

ASSIGNMENT SHEET #1-CHECKLIST ON SUCCESSFUL CHAPTER OPERATIONS

Each member should complete the checklist evaluating chapter co-operation. Answer each question yes or no.

- _____ 1. Are the officers selected through a nominating committee on the basis of special qualifications? _____ Do they meet frequently to plan work and receive assistance?
- _____ 2. Are school authorities and others concerned consulted and kept informed on the activities of the chapter?
- _____ 3. Does the chapter have a written program of activities formulated by the members? _____ Was last year's program completed?
- _____ 4. Is there a committee functioning on each division of the present program of activities?
- _____ 5. Does the chapter have a written budget based primarily on the program of activities and a sound plan developed for securing the necessary funds with which to operate?
- _____ 6. Is the expenditure of chapter funds properly safeguarded?
- _____ 7. Do a high percentage of members get experience in the work of the chapter and do they have definite responsibilities that contribute to its success or failure?
- _____ 8. Does the chapter possess the standard meeting equipment and is it properly mounted and protected?
- _____ 9. Has a satisfactory system of chapter records and reports been developed?
- _____ 10. Is at least one planned meeting held each month when sufficient time is available to take care of all chapter business? _____ Is the program for each chapter meeting posted in advance? _____ Is accepted parliamentary procedure followed?
- _____ 11. Does the chapter name an executive committee with power to act for the chapter when necessary?
- _____ 12. Do all of the students enrolled in vocational agriculture belong to the chapter? Are qualified members advanced systematically to higher degrees of membership?

- _____ 13. Does the chapter have over ninety percent of its members in attendance at regular meetings?
- _____ 14. Do a high percentage of members know what they should about FFA? _____ Is systematic, continuous leadership training given to all members starting with them as Greenhands?

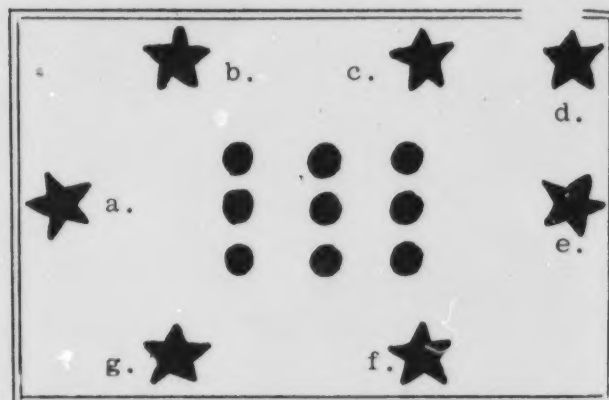
DUTIES AND RESPONSIBILITIES OF FFA MEMBERS

TEST

1. List the order of business for a FFA meeting.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.
 - i.
 - j.
 - k.
 - l.
2. List six items that constitute a good FFA meeting.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.

3. Identify the location of the FFA officers' stations for a FFA meeting by stating the correct office in the blanks provided.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____



4. List five areas of the program of activities.

- a.
- b.
- c.
- d.
- e.

5. List the purpose for which committees are formed.
 - a.
 - b.
 - c.
 - d.
6. Discuss in a short paragraph the proper use of the FFA jacket or blazer.
7. List six items in the code of ethics.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
8. List five leadership activities that would apply to the FFA chapter and community.
 - a.
 - b.
 - c.
 - d.
 - e.

9. List three purposes of the Future Farmers Supply Service as related to the local chapter.
 - a.
 - b.
 - c.
10. Describe briefly two activities that a local chapter can participate or sponsor during National FFA Week.
 - a.
 - b.
11. Complete checklist on successful chapter operation.

(NOTE: If this has not been accomplished prior to the test, ask the instructor when the above activity should be completed.)

DUTIES AND RESPONSIBILITIES OF FFA MEMBERS

ANSWERS TO TEST

1.
 - a. Opening ceremony
 - b. Minutes of previous meeting
 - c. Orders of the day
 - d. Officers' reports
 - e. Reports on chapter program of activities
 - f. Special features
 - g. Unfinished business
 - h. Committees' reports
 - i. New business
 - j. Degree and installation ceremonies
 - k. Closing ceremony
 - l. Entertainment, recreation, refreshments
2. Any six of the following
 - a. Effective use of an executive committee to assure careful planning in advance of the meeting time.
 - b. Starts and closes on time
 - c. Proceeds according to an established order of business
 - d. Conducted according to accepted parliamentary procedure
 - e. Includes well-prepared committees', secretary's treasurer's reports
 - f. Shows that each officer is familiar with his or her duties and responsibilities
 - g. Commands the interest and attention of all members
 - h. Provides for maximum member participation and develops the cooperative attitude
 - i. Includes business, entertainment features, and refreshments

- j. Moves along with "snap" thus preventing monotony and the wasting of time
- k. Proceeds with a minimum of active participation by the Advisor
- 3.
 - a. President
 - b. Secretary
 - c. Advisor
 - d. Sentinel
 - e. Vice-President
 - f. Treasurer
 - g. Reporter
- 4. Any five of the following
 - a. Supervised agricultural occupations experience
 - b. Cooperation
 - c. Community service
 - d. Leadership
 - e. Earning and saving
 - f. Conduct of meeting
 - g. Scholarship
 - h. Recreation
 - i. Public relations
 - j. State and national activities
 - k. Alumni Relations
- 5.
 - a. To reach chapter goals
 - b. To accomplish specific work assignments
 - c. To deal with specific problems
 - d. To research and make recommendations about new areas of interest
- 6. Discussion should include some of the following
 - A. The jacket or blazer should only be worn by persons who are members of the organization

- b. It should be kept clean and neat at all times
- c. The jacket should have only a large emblem on the back and a small emblem on the front; the name of the State Association and the name of the local chapter on the back; and the name of the individual and one office or honor on the front
- d. For the most attractive appearance, the jacket should be worn on official occasions with the zipper fastened to the top. The collar should be turned down and the cuffs in place and buttoned
- e. The jacket or blazer should be worn by officers and members on all official FFA occasions, as well as other occasions where the chapter is represented. It may be worn to school and other appropriate places
- f. The jacket or blazer should only be worn to places that are appropriate for members to visit
- g. The jacket should be worn by contestants in the National Public Speaking Contest, and at other occasions when FFA members are receiving FFA awards
- h. School letters and insignia of other organizations should not be attached to or worn on the jacket
- i. The jacket or blazer should not be worn with garments bearing the insignia of other organizations
- j. When the jacket becomes too faded and worn to wear in public; it should be discarded or the emblems and lettering should be removed
- k. The emblems and lettering should be removed if the jacket or blazer is given or sold to a non-member
- l. A member always acts like a lady or gentleman when wearing the jacket or blazer
- m. Members should refrain from smoking while wearing the FFA jacket or blazer or officially representing the organization
- n. All chapter degree, officer, and award medals should be worn beneath the name on the right side of the jacket, with the exception that a single State Farmer charm and American Farmer key should be worn above the name or attached to a standard key chain. No more than three medals should be worn on the jacket; these should represent the highest degree earned, the highest office held, and the highest award earned by the member

7. Any six of the following

132

- a. Dress neatly and appropriately for the occasion

- b. Show respect for the rights of others and be courteous at all times
 - c. Be honest and do not take unfair advantage of others
 - d. Respect property of others
 - e. Refrain from loud, boisterous talk, swearing, and horseplay
 - f. Demonstrate sportsmanship in the show ring, judging contests, and meetings
 - g. Attend meetings promptly and respect the opinions of others in discussion
 - h. Take pride in the FFA organization, activities, farming programs, exhibits, and in the occupation of farming and ranching
 - i. Share with others experiences and knowledge gained by attending national and state meetings
8. Any five of the following
- a. Provide special training for newly elected officers
 - b. Elect auxiliary officers
 - c. Conduct chapter public speaking contest
 - d. Provide experience in parliamentary procedure
 - e. Provide experience in conducting meetings
 - f. Participate in a chapter leadership training school
 - g. Send members to state and district conventions
 - h. Encourage sending president to FFA National Leadership Conference
 - i. Provide committee work
 - j. Assist members to apply for the higher degrees
 - k. Encourage participation in school activities that involve leadership
 - l. Encourage participation in community activities
- 9.
- a. Supplies all official FFA merchandise
 - b. Insures uniformity in official FFA merchandise
 - c. Provides high-quality official merchandise

10. Description should include any two of the following
 - a. Radio and TV programs
 - b. FFA Week articles in newspapers
 - c. School assembly
 - d. Civic club program
 - e. Parent and son banquet
 - f. Posters displayed around town
 - g. Attend church as a group
 - h. Window displays
 - i. Others that the chapter approves
11. Evaluated to the satisfaction of the instructor.

THE FFA CREED

OBJECTIVES:

Upon completion of this unit, the student will be able to:

1. Say or be able to write the creed.
2. Explain the meaning of each paragraph.
3. Develop self confidence by speaking.

INSTRUCTOR USE GUIDE:

1. Have students read the creed and say it to themselves several times.
2. Have those who wish to recite the creed in front of the class do so.
3. Hold a chapter contest with Alumni, Advisory Committee members and the speech teacher judging the contest.
4. Use FFA Student Handbook and FFA Official Manual as references.
5. Have everyone write the creed from memory.
6. Review contest rules and regulations and scoresheet with students so they will know how they are being scored.

REFERENCES:

Advisors Handbook, page 100.

Student Handbook, pages 14-20.

FFA Manual, page 9.

The FFA Creed

I believe in the future of farming, with a faith born not of words but of deeds-achievements won by the present and past generations of agriculturists; in the promise of better days through better ways, even as the better things we now enjoy have come to us from the struggles of former years.

I believe that to live and work on a good farm, or to be engaged in other agricultural pursuit, is pleasant as well as challenging; for I know the joys and discomforts of agricultural life and hold an inborn fondness for those associations which, even in hours of discouragement, I cannot deny.

I believe in leadership from ourselves and respect from others. I believe in my own ability to work efficiently and think clearly, with such knowledge and skill as I can secure, and in the ability of progressive agriculturists to serve our own and the public interest in producing and marketing the product of our toil.

I believe in less dependence on begging and more power in bargaining; in the life abundant and enough honest wealth to help make it so-for others as well as myself; in less need for charity and more of it when needed; in being happy myself and playing square with those whose happiness depends upon me.

I believe that rural America can and will hold true to the best traditions of our national life and that I can exert an influence in my home and community which will stand solid for my part in that inspiring task.

The creed was written by E.M. Tiffany, and adopted at the 3rd National Convention of the FFA. Revised at the 38th Convention.

SCORE CARD - CREED SPEAKING CONTEST

Contestant	Accuracy 25 pts.	Power of Expression 25 pts.	Stage Presence 15 pts.	General Effect 20 pts.	Response to Questions 15 pts.	Total Points
1.						
2.						
3.						
4.						
5.						
6.						

Final Placing:

	<u>Name</u>	<u>Chapter</u>	<u>Score</u>
1.			
2.			
3.			
4.			
5.	137		139

CREED SPEAKING CONTEST

This contest is designed to give younger members an opportunity to participate in an activity where they may display their leadership and speaking abilities.

RULES AND REGULATIONS

1. Contestants must be in their first year of Vocational Agriculture and not above the sophomore level.
2. Contestants will recite from memory the FFA Creed as printed in the latest edition of the Official FFA Manual, and shall only use the introduction, "The FFA Creed," by E.M. Tiffeney.
3. There will be no time limit on individual delivery of the Creed.
4. The contest will be held on the chapter, sub-district (in divided districts), district, sectional and state-level.
5. At the State Contest one Identical Question shall be asked each contestant. Other contestants are to be off stage where the question and response can not be heard.
6. Contestants will be judged on the following:
 - 25 points - Accuracy: Minor deductions for misplaced words or added word.
 - 25 points - Power of Expression: The conveyance of thought and meaning.
 - 15 points - Stage Presence: The personal appearance, poise, body posture, ease before the audience, and use of official dress.
 - 20 points - General Effect: The extent to which the creed was interesting, understandable, and convincing.
 - 15 points - Response to Questions: Ability to satisfactorily answer the question showing originality and familiarity.

CREED SPEAKING

CREED SPEAKING

The contestant memorizes and recites the creed and responds to questions concerning the creed. (Usually limited to freshman.)

Suggestions for Implementing: This contest is to encourage new members to memorize the recite the official FFA Creed.

1. Locate the rules, regulations and scorecard used in your state. A sample copy follows which may give you an idea how the contest is conducted:
2. Orient all the new members regarding the creed and the contest in your classes.
3. Utilize an FFA committee in making arrangements for a local contest. Considerations for the committee are:
 - a. Select and prepare a master of ceremonies
 - b. Select, invite and prepare judges
 - c. Invite special guests
 - d. Select time, date, and place
 - e. Make arrangements for contest site and needed equipment
 - f. Provide refreshments
4. Prepare top speaker(s) for competition above the chapter level.
 - a. Give the member opportunities to say the creed to others:
 - 1) Other classes
 - 2) At the FFA chapter meeting
 - 3) During an FFA program to another organization
 - 4) Practice sessions at night
 - 5) Use the audiovisual equipment
 - b. Notify participant of time, place and date of contest in sufficient time.
 - c. Receive approval from school administration if school time is to be missed.
 - d. Make out permission slip for transportation to the contest.
 - e. Invite parents and/or other adults to attend.
5. Recognize ALL students' accomplishments
 - a. Awards banquet
 - b. Bulletin board
 - c. School paper
 - d. News media
 - e. Personal contact

Sample Rules for Creed Contest: This contest is designed to develop leadership and the ability to appear before groups by 9th grade students as they become members of the FFA. Emphasis will be placed upon a knowledge of the FFA Creed as adopted at the 38th National Convention. This event also supplements the public speaking contest in developing leadership. The

rules governing the sub-district, district, and state contests, in addition to those for all events are as follows:
(Sample)

1. Each chapter is entitled to one freshman (9th grade student) representative in a district contest. It is suggested that this member be selected in a chapter contest held prior to the sub-district contest.
2. The judges in each district shall designate the two highest contestants to compete in the sectional contest.
3. One contestant from each section competes in the state contest.
4. Each contestant must recite from memory, the FFA Creed without any opening or closing comments. Training in delivery is limited to the facilities of his school.
5. Three minutes are allowed for questions which shall be asked the contestant by the judges to test his/her understanding of the Creed. Each judge is to ask the same question of each contestant.

Rating by Judges: Points to be considered in scoring contestants are:

- | | | |
|----|---|-----|
| a. | Voice | 100 |
| | Quality, pitch, force, articulation, pronunciation | |
| b. | State Presence | 100 |
| | Personal appearance, poise and body posture, confidence, personality, ease before audience | |
| c. | Power of expression. | 100 |
| | Fluency, emphasis, directness, sincerity, communicative ability, conveyance of thought and meaning. | |
| d. | General effect | 100 |
| | Extent to which the speech was understandable, convincing, pleasing and held attention | |
| e. | Response to questions | 200 |
| | Ability to satisfactorily answer the questions of the judges showing an understanding of the Creed | |

Total. 700

SMALL GASOLINE ENGINE WINTERIZATIONOBJECTIVES

Upon completion of this unit, the student will be able to:

1. Properly prepare a small gasoline engine for winter storage.
 - a. Clean, repair and protect from corrosion on exposed metal parts.
 - b. Service the fuel system.
 - c. Protect internal metal parts.
 - d. Service the air cleaner.
 - e. Service the lubrication system.
 - f. Protect from physical damage.
 - g. Store safely.

References

1. Small Engines - Volume 1 - AAVIM
2. Small Gasoline Engines - Operation and Maintenance - Hobar Publications

Teaching Aids

1. Have students each bring a small engine for winterization, not overhaul but winterization. (examples: Lawn mower, rototiller, etc.)

Student Activities

1. Perform all operations necessary to winterize a small engine.
 - a. Clean and repair physical damage to structure of equipment.
 - b. Air cleaner service.
 - c. Fuel system service and drainage.
 - d. Oil change.
 - e. Store in a protected location.

Instructor Activities:

1. Discuss winterization and the importance of winterization.
2. Demonstrate cleaning the engine thoroughly and protecting exposed metal parts with paint, oil or grease.
3. Demonstrate engine warm-up, draining oil, refill oil to correct level and servicing the air cleaner.
4. Demonstrate servicing the fuel system and pro-

tecting internal parts by "Stow-it" by McCulloch (these products are very high in rust inhibitors and protect internal parts by simply running the engine with the product in the fuel).

5. Demonstrate cleaning and regapping the spark plug. If a rust inhibitor (like "Stow-it") was not run through the fuel system then add two tablespoons of crankcase lubricant through the spark plug hole and turn the engine over 3 or 4 times before reinstalling the spark plug.
6. Demonstrate proper care and protection of external parts of the equipment (i.e. Sharpen and balance the mower blade, clean and condition rotatiller bars, etc. - protect these areas with paint, oil or grease - light coats).

SUBJECT MATTER OUTLINE:

When properly prepared for storage, engines have been known to start and run perfectly after remaining in storage for five years or longer. You probably never expect to store an engine this long; but if you do not plan to use your small engine for six months or more, you should protect it from the following:

- Corrosion of any metal and iron parts such as the valves, cylinder, piston and piston rings plus exposed metal parts like mower blades.
- Gum which develops from left-over fuel in the fuel system. Gas goes stale in storage and is difficult to ignite after long storage.
- Moisture that collects on the outside of the engine and penetrates into the electrical system. And moisture which has collected on the inside of the engine, having the potential to cause sludge deposits in the oil.
- Dust and dirt which accumulate on the outside of the engine and interfere with engine cooling.
- Physical damage like being backed over.

Corrosion during storage is not as great a problem now as it once was. Crankcase oils with a SE service classification contain rust inhibitors which help protect the internal cast iron and steel parts. Also, many small-engine cylinder blocks, cylinders and pistons are now made of aluminum. Aluminum will not rust but it does corrode. This corrosion is evidenced by flakes of aluminum coming off or white rough spots appearing on aluminum parts. All rust and corrosion can be prevented by proper care. There may also be a problem with rust flakes accumulating in the fuel tank on older engines with steel gasoline tanks. Many manufacturers are making tanks from plastic and non-corrosive metals today.

Cast iron piston rings, valves and other steel parts must be protected from corrosion during long periods of storage. Manufacturers continue to recommend that you protect your engine with a rust preventive before storing it. This protection can take the form of a rust inhibitor in the fuel, or oil in the cylinder, through the spark plug hole. Use a pre-storage fuel treatment (ie. McCulloch's "Stow-it") to treat the fuel just before draining all fuel from the fuel system. These products are high in rust inhibitors and will protect cast iron and steel parts from rusting. A second alternative is to place two tablespoons of oil in the spark plug hole. Turn the engine over

3-4 times, clean and gap the spark plug and replace the spark plug. Do not run the engine after this treatment until you intend to take it out of storage.

Gum deposits from stale gasoline stored in an engine clog the carburetor and other parts of the fuel system. Gasolines on today's market have gum inhibitors which slow down the formation of gum deposits. Stale gasoline has had the volatile components evaporate, thus only heavy fuel remains. This condition will prevent a carburetor from atomizing the fuel and since solid fuel does not burn a person has great difficulty starting an engine in the spring. Experience has shown that when fuel is drained from the fuel system of a stored engine, it usually starts and runs without difficulty when taken out of storage. It is important that tank fuel lines and carburetor are thoroughly drained. If drainage of the fuel system is not done many times, it is necessary to disassemble and clean the carburetor to remove gum deposits, so prevent this problem by draining the fuel. Draining the fuel from the fuel system also eliminates a fire hazard from fuel stored in the fuel tank.

Moisture condenses on the outside and the inside of the engine while it is not being used. This can be harmful to the electrical system even when the remainder of the engine has been protected by a rust preventive. Moisture helps to oxidize the breaker points and electrical connections. This oxide layer becomes an insulator thus preventing the proper flow of electricity. It may also cause the condenser to short; then the breaker points arc and become pitted. Therefore, a small engine should be stored inside and preferably covered with plastic. Moisture will also cause corrosion of steel parts that are not protected otherwise, therefore, protect the exposed metal parts with paint, oil or grease.

Dust and dirt which collected on the engine during storage will stick to the cooling fins and will interfere with cooling when the engine is put back into operation. There is also danger of the dirt getting inside the engine when you service it for operation and/or when you remove various parts for maintenance or repair. Dirt inside the engine causes rapid wear. Use a product like "Gunk" and wash the equipment thoroughly, a pressure cleaning system works well if one is available. It is important for engine and machine longevity that the engine be thoroughly cleaned.

Your engine may be ruined by physical damage during storage if you do not put it in a safe place. When stored in a machinery shed or garage, it can be run over by a tractor, truck or other vehicle. Falling objects may break the cooling fins and bend the cylinder baffles. This would cause the engine to overheat. Store small equipment out of the way of trucks, tractors and large equipment which is used during

the winter.

Preparing your engine properly for storage and keeping it in a safe place may also prevent injury to some one who may trip and fall over it. There is also a danger of children and other inexperienced persons starting or trying to operate the equipment if fuel is left in the fuel system. This is especially true with engines on such machines as chain saws, portable generators, small tractors, mowers, and air compressors. For safety, remove the key or spark plug wire if possible when storing equipment.

The end of the season is always a good time to check, clean, service, repair and prepare your engine for winter storage. For one reason, if you find repairs that need to be made, you can do them at that time or you can make a note to do them at a more convenient time before the next operating season. This will assure equipment that is in good operating condition when you need to use it next year. A second reason for cleaning is to remove dirt and grime which tend to collect more dirt during storage. Furthermore, you will enjoy taking a clean engine - one that is ready for work - out of storage. It will be almost like having a new engine.

LAB EXERCISE:

Complete the laboratory exercise for an engine which is being prepared for long time storage. As you perform this exercise check each step as it is completed.

Name: _____ Type of Equipment: _____

Make of Engine: _____ Serial Number: _____

Model: _____ Cycle 2 or 4 _____

- _____ 1. Clean the outside of engine
- _____ 2. Properly service the fuel system.
 - _____ a. Start engine to use all the fuel in carburetor and line. (Use "Stow-it" for internal rust prevention.)
 - _____ b. When engine starts to sputter operate choke lever which will help drain carburetor.
 - _____ c. Remove carburetor bowl (if carburetor is so equipped) clean and reinstall.
 - _____ d. Clean or replace fuel filters or strainers (if the system is so equipped).
- _____ 3. Drain crankcase oil from the engine. Fresh oil should be added to the proper level. (Use SAE 30 weight with service classification SE)
 - _____ a. Remove spark plug and insert two tablespoons of SAE 10 crankcase oil in cylinder. (Omit this step if you used "Stow-It: in the fuel)
 - _____ b. Crank engine several revolutions to distribute oil. Stop engine with piston at T.D.C. so both valves are closed.
 - _____ c. Replace spark plug and torque correctly but leave plug wire disconnected.
 - _____ d. Service or change oil filter if applicable.
- _____ 4. Service air cleaner.
- _____ 5. Service battery if battery ignition system is involved.
- _____ 6. Service equipment parts (i.e. Sharpen and balance lawn mower blade - *note, remove rotary lawn mower blade bolts with an air or electric impact wrench. Replace this bolt if the bolt head begins to round. Sharpen blade to 45° angle as indicated on the next page and paint, oil or grease the freshly ground surface.)
- _____ 7. Coat exposed unpainted surfaces with paint, grease of oil.
- _____ 8. Store inside building if possible; if not, cover.

Beef CattleInstructor's Guide

1. There are three parts to this unit (a) Breed Identification, (b) Basic Management, (c) Beef Selection. You may chose to use all three or put more emphasis on livestock skills. For instructional information on livestock skills (castrating, dehorning, etc.) write for a catalog to Texas A&M. (Address provided in number seven below) Livestock skills are planned for the AgII guide.
2. Have students write to the breed association to gather information.
3. Have students report their findings.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds and to practice selection.
6. Use slide sets of breeds to identify breed traits.
7. The slide sets are available from either of the following sources:
 - a. Vocational Instructional Services
Texas A & M University
F.E. Box 182
College Station, Texas 77843
 - b. Vocational Agricultural Service
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801
8. Use Extension Service Estimated Gross Sales materials to develop an introduction and motivation for all production units (copies included in the Introduction and as part of this unit).
9. Terminology handout and chart are located on page 7,8 & 9 and a breed Identification Summary Chart is located on page 10.
10. A test is located on page 41 & 42 with answers on page 43.
11. Student activities are located on pages 44, 45, & 46.
12. There is a Selecting Beef Cattle student materials booklet available from Texas A & M University that goes with the Beef Selection unit if you desire to use it.

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed association.
3. Compare the advantages and disadvantages of various beef breeds.
4. Select the breeds most suited to their location and production situation.
5. Understand and be able to use terms common to the beef industry.
6. Identify major breeds of beef cattle.
7. List the physical traits and production characteristics of major breeds of beef cattle.
8. Understand basic management concepts of beef production.
9. Select animals on conformation.

References

1. Ensminger, M.E., Stockman's Handbook, 5th edition, 1981, Interstate.
2. Gillespie, James R., Modern Livestock and Poultry Production, 1981, Delmar.
3. OSU Extension information on Beef production (ie. Understanding Calf Scours, White Muscle and Other Selenium-Responsive Diseases of Livestock, Synchronizing Estrus in Beef Cows).
4. Texas A & M Student Manuals or Illinois instruction materials on Beef breeds and selection.

Teaching Aids

1. Overhead projector with transparencies included in this guide.
2. Breed association publications.
3. Slides of beef breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of beef.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Introduction and Motivation

The following is some statistical information you may find beneficial in introducing the importance of any of the livestock or crops units provided in this guide. The information provided is for sales of agricultural products in Oregon. Annual updates can be secured each December by requesting them from:

Stanley D. Miles, Extension Economist
219 Extension Hall
Oregon State University
Corvallis, Oregon 97331

Use both state and county information in developing your introduction. You may also find Commodity Data and Enterprise Data useful, they may be secured from local Extension offices. These sheets will provide production practices and economic trend information.

An example introduction follows:

Cattle and calf income to the state of Oregon is the Number One agricultural income producing commodity at \$313,882,000 in 1980. In our county, Umatilla County, cattle and calves income for 1980 was \$25,522,000. There is a substantial potential for young people who are interested in cattle production to get involved.

In order to make money in the cattle business we must first make wise breed selection and that's what this unit is all about.

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

-1980

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	15,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,674
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*
TOTAL CROSS FARM SALES		1,742,337	1,494,437	1,253,984

p - Preliminary

r - Revised

*Includes nursery crops and turf sod.

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand dollars														
THE STATE....	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,681	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,334	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	188,598
Multnomah...	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington...	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	198	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Cook.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook...	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,996	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	687	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,009	38,735
Josephine...	56	439	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	398,246
Gilliam....	20,227	199	226	108	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Hood River...	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla...	83,314	6,121	794	19,921	12,237	106	12,167	2,700	137,360	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,892	2,448	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,108
Wallowa....	6,244	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes...	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,709
Harney....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson...	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,880	682	1,960	36,822	83,619
Lake.....	1,431	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

OREGON
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
								thousand dollars	thousand dollars						
THE STATE...	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,494,417
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,253
Benton....	3,870	386	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas..	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,860	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah..	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,002	1,823	12,443	44,495
Washington..	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop....	---	43	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,886	4,744	6,838
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,034	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook..	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,091
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,516	37,380
Josephine..	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	583	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River..	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,630	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	766	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa....	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes..	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,986
Jefferson...	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

Glossary of Common Terms
of the Beef Cattle Industry

Commercial Herd - A herd of animals used to produce animals which will eventually be slaughtered for meat.

Creep Fed - The supplementary feeding of young animals while nursing.

Wintered - A term used to describe the way an animal was fed through the winter season.

Supplement - Additional feed given to animals.

Purebred - An animal which may or may not be registered, that is of a recognized breed which has been kept pure many generations.

Hybrid Vigor - Vigor usually possessed by hybrid animals.

Crossbreeding - The breeding of animals of two different breeds.

F₁ Females - Female cattle from the first cross of mating of two different pure breeds of cattle.

Standard Breeds - Traditional and newly established beef breeds used by cattlemen in the breeding programs in the U.S..

Exotic Breeds - New European breeds and others which are currently being imported to the U.S..

Crossbred Breeder - A breeder of livestock producing animals that are the offspring of animals of two different purebreds.

Purebred Breeder - A breeder of animals whose ancestors are all of the same breed (may or may not be pedigreed).

Artificial Breeding or Insemination - Depositing the male semen into the female reproductive tract by artificial means.

Bloodline - A family or family line of breeding.

Bull - The male of the bovine species (cattle).

Calf - An animal of the bovine species under one year of age and of any sex.

Lactation - Period female animal gives milk.

Commercial Breeder - A breeder of animals for the commercial markets.

Baby Beef - Prime or choice cattle from 12-13 months old and weighing 700-1200 pounds.

Springer - A cow showing signs of pregnancy.

Pedigree - A table presenting a line of ancestors for an animal.

Bovine - Cattle species.

Scrub - An animal of inferior merit and usually of mongrel breeding.

Stockers - Young growing cattle, both steers and heifers; steers not old enough for feeders and heifers not old enough to produce their first calf.

Veal - Young calf fat enough to slaughter (125 - 300 pounds).

Bangs Disease - Contagious disease which causes cattle to give premature birth to their young.

Bloat - Sudden and often fatal distension of the abdomen in animals.

Cow - A female of the bovine species after she has had her first calf.

Feeders - Cattle, hogs, or sheep to be fattened for market.

Heifer - Female of the bovine species that has not yet produced a calf.

Polled - Without horns.

Steer - Male of the bovine species that was castrated before he started to show masculine characteristics.

Castration - removal of the testicles, or sex glands, of the male.

Cross Bred - An animal whose sire and dam are of different breeds.

Sire - In cattle terms, the male parent of the offspring.

Dam - In cattle terms, the female parent of the offspring.

Dressing Percentage - Weight of the carcass of an animal expressed as a percentage of the living weight.

Gestation Period - The period between breeding of the female and birth of the offspring.

In-breeding - The mating of very closely related animals as full brother and sister.

Grade Animal - Usually applies to any animal which is not pure-bred.

Line Breeding - The mating of animals that are related, but which are not as close as brother and sister.

Mongrel - An animal of nondescript or mixed breeding.

Parturition - The act of giving birth to young, applies to all animals.

Pure-bred - An animal carrying only the blood of some one breed.

Scrotum - The pouch of skin containing the testicles of the male animal.

NAME _____

	YOUNG	PARTURITION	YOUNG		MATURE		CASTRATION	GESTATION PERIOD	DRESSING %	HEAT CYCLE	DURATION OF HEAT
			♀	♂	♀	♂					
CATTLE											
SHEEP											
SWINE											
HORSES											
GOATS											
CHICKENS											

AGI-VI-11

BREEDS

Name _____

BREED	PLACE OF ORIGIN	COLOR	DISTINCTIVE HEAD CHARACTERISTICS	OTHER DISTINGUISH- ING CHARACTERISTICS	REASON TO BUY THE BREED ADVANTAGES &/OR DISADVANTAGES
					193
		192			

ANIMAL SCIENCE

Breeds and Selection of Livestock

Breeds of Beef Cattle

*Terms: All terms underlined are included in the "Glossary of Terms."

Note: A slide set, "Breeds of Beef Cattle," is available from Vocational Instructional Services, Texas. Also a slide set, "Standard and Exotic Breeds of Beef Cattle," is available.

I. Importance of the Breed

Beef production is one of the largest agricultural industries in the United States. In 1980 there were approximately 100 million beef cattle in the United States. The beef cattle industry includes three systems of production: (1) feeder cattle production, (2) slaughter cattle production, and (3) breeder cattle production. The primary purpose of the beef cattle industry is the production of meat for human consumption, although hides and other by-products are of economic importance.

The cow-calf program for the production of feeder cattle is the very foundation of beef cattle production in Oregon and in the United States. The producers of feeder cattle are generally those farmers and ranchers who maintain a commercial herd of beef cattle. The calves are generally born in the spring and run on pasture with the cows during the grass season until weaning time at approximately six months of age. Some calves are creep fed to supplement growth while nursing. In some areas, the calves are held after weaning and wintered on winter forages or hay and supplement feed and sold as yearlings. About 97% of the beef cattle in the United States are of commercial breeding; however, most commercial calves are sired by purebred bulls.

Cattle breeders who maintain purebred herds do so mainly for the production of breeder cattle. Purebreds denote a group of animals having a common origin and possessing certain distinctive characteristics which are transmitted with reasonable uniformity from parent to offspring. These purebred generally represent a breed. Purebreds are a small but important minority. They have been the major factor in the beef improvement of the past and will continue to exert a powerful influence in the future. Competition among the various breeds of purebred cattle has forced breeder producers to use the most highly scientific methods for breed improvement. The production of purebred cattle is a specialized system of production. The purebred

breeder has the responsibility of furnishing foundation stock or replacement stock to other purebred breeders as well as to provide purebred bulls for the commercial producer. Also, hybrid vigor derived from sound crossbreeding programs has placed an even greater demand on breeder producers to provide F₁ females for use in commercial breeding programs.

With this background information on the various facets of the beef cattle industry, we are now ready to examine more closely the identifying characteristics of the various beef breeds. These breeds may be categorized into two groups, standard breeds and exotic breeds. Breeds may be developed as the result of planned matings or due to chance. Once the breed has evolved, a breed association is usually organized.

<u>STANDARD BREEDS</u>	<u>BREEDS OF AMERICAN</u>	<u>EXOTIC BREEDS</u>
(Imported)	<u>ORIGIN</u>	(Imported)
ANGUS	BARZONA	BLOND D'AQUITAINE
BRAHMAN	BEEFMASTER	CHIANINA
BROWN SWISS (Beef)	BRANGUS	GELBVIEH
CHAROLAIS	CHARBRAY	HAYS CONVERTER
DEVON	POLLED HEREFORD	LIMOUSIN
GALLOWAY	POLLED SHORTHORN	LINCOLN RED
HEREFORD	RED BRANGUS	MAINE-ANJOU
MILKING SHORTHORN	SANTA GERTRUDIS	MARCHIGIANA
RED ANGUS		MURRAY GREY
RED POLL	<u>CROSSBREEDS</u>	PIEDMONT
SCOTCH HIGHLAND	(Resulting from first	PINZGAUER
SHORTHORN	cross of any two of	SIMMENTAL
	the purebred breeds)	SUSSEX
		WELSH BLACK

II. STANDARD BREEDS (Imported)

BREED	ORIGIN	CHARACTERISTICS
Angus	A. Origin Northeastern counties of Aberdeen, Angus, Kincardin, and Forfar in Scotland. B. Native home is Northeastern Scotland. C. The first importation was a cow in 1850 from Scotland. D. George Grant imported three bulls in 1873 for use on commercial cattle. E. First herd was imported to Canada in 1876.	1. Color..... Black, but small amount of white on the underline behind the navel is permissible. 2. Polled 3. Size..... a. Compact, closely built, smooth but muscled. b. Average Mature Weight: (1) Male: 1000-1400 lbs. (2) Female: 750-900 lbs. 4. Sexual Maturity.. a. Male: 7-10 months b. Female: 6-9 months 5. Temperament..... Nervous in nature but generally easily gentled. 6. Production..... a. Breeding Performance (1) Easily adapted to hot and cold climates (2) Good mothering ability (3) Highly prolific (4) High percent birth rate (5) Low to average birth rate (6) Average milkers (7) Average growth weight (8) High % weaning rate b. Feeding Performance (1) Average to high feed conversion (2) Average to high daily weight gain (growth rate)

BREED	ORIGIN	CHARACTERISTICS
Angus (Continued)		(3) Average to high live grade c. Slaughter Preformance (1) High carcass grade (2) Average dressing % (3) Average to high % of high priced cuts (4) High % of marbling (5) High tenderness (low shear force)

Brahman	A. Originated in India	1. Color White to dark gray with black humps, necks, and lower legs, light to dark red, gray or red with white, red, or brown spots, brown and black with white spots.
		2. Horned..... With large hump over shoulders, abundance of loose skin under neck and dewlap
		3. Size a. Large, long legs, slender bodies, heavily muscled b. Average Mature Weight: (1) Male: 1400-2000 lbs. (2) Female: 1000-1250 lbs.
		4. Sexual Maturity.. a. Male: 12-15 months b. remale: 11-13 months
		5. Temperament..... Extremely docile if quietly handled, but highly nervous if mishandled
		6. Production..... a. Breeding Performance (1) Adapted to hot dry climate (2) Average mothering ability

BREED

ORIGIN

CHARACTERISTICS

Brahman (continued)

- (3) Average prolificacy
- (4) Average birth rate
- (5) High birth weight
- (6) Good milkers
- (7) High growth rate
- (8) Average % weaning rate
- b. Feeding Performance
 - (1) Average to high feed conversion
 - (2) High daily rate of gain
 - (3) Low to average live grade
- c. Slaughter Performance
 - (1) Average to high carcass grade
 - (2) Average dressing %
 - (3) High % high priced cuts
 - (4) Low marbling
 - (5) Low tenderness (high shear force)

Brown Swiss
(Beef)

- A. The native home of the Brown Swiss breed is Switzerland.
- B. Most of the early improvement of the breed occurred in the canton (state) of Schwyzer.
- C. The first Brown Swiss cattle were brought to the United States by Henry M. Clark of Massachusetts in 1869.

1. Color.....Brown, although the shade may vary from light brown carrying a slivery cast to an extremely dark brown

2. Horned

3. Size a. Brown Swiss are one of the largest and most heavily muscled of all dairy breeds
 b. Average Mature Weight
 (1) Male: 2000-2500 lbs.
 (2) Female: 1400-1600 lbs.

4. Brown Swiss are rather slow maturing.

AEI-VI-17

BREED

ORIGIN

CHARACTERISTICS

Brown Swiss (Continued)

5. Temperament..... Usually quiet, docile, and easily managed.
6. Production..... The Brown Swiss is often referred to as the "American Exotic."
- a. Noted for ruggedness and strong constitution
 - b. Calves weigh 90-100 lbs. at birth and make good vealers.
 - c. Steers have been found to gain 10 to 15% faster than other beef steers fed to the same age.
 - d. Carcasses have less finish, but the quality is very satisfactory.
 - e. Excellent mothering ability with high milk production.
 - f. Crossbreeding value for greater size and thriftiness.

Charolais

A. Originated in the province of Charolles in central France

1. Color..... White to cream; animals with black noses, spotted, or excessively dark colored pigmentation are disqualified.
2. Horned
3. Size.....
- a. Large, heavily muscled, upstanding
 - b. Average Mature Weight:
 - (1) Male: 15000-2000 lbs.
 - (2) Female: 1100-1400 lbs.

BREED

ORIGIN

CHARACTERISTICS

Charolais (Continued)

4. Sexual Maturity... a. Male: 10-13 months
Female: 9-12 months
5. Temperament..... Docile, easily handled, good natured
6. Production..... a. Breeding Performance
 - (1) Adapted to cool and warm climates
 - (2) Average to high mothering ability
 - (3) Average prolificacy
 - (4) Average birth rate
 - (5) High birth weight
 - (6) Good milkers
 - (7) High growth rate
 - (8) Average & weaning weight
 b. Feeding Performance
 - (1) Average to high feed conversion
 - (2) High daily rate of gain
 - (3) Average live grade
 c. Slaughter Performance
 - (1) Average carcass grade
 - (2) High dressing %
 - (3) High % high priced cuts
 - (4) Low % marbling
 - (5) Low to average tenderness (high shear force)

Devon

A. Originated in Devon County, England

B. First brought to the U.S. by the colonists early in the seventeenth century

1. Color..... Red-ranging from a pale chestnut to a rich, deep red. Commonly known as "Red Rubies."
2. Horned..... Creamy white with black tips

BREED	ORIGIN	CHARACTERISTICS
Devon (Continued)	C. Originally thought of as a dual-purpose breed, but for the past 25 years have been directed primarily to beef production	3. Size..... a. Cattle are smaller than the traditional beef breeds and show more refinement in their conformation and bone. 4. Production..... a. Cows are considered as good milkers b. Cattle placed in fattening lot produce high quality beef.
Galloway	A. Originated in the southwestern district of Galloway in Scotland B. Earliest importation to the U.S. was made in 1853	1. Color..... Black; however, a brownish or reddish tint frequently occurs; also characterized by long, curly hair with a mossy undercoat 2. Polled 3. Size..... Smaller in body size than other beef breeds 4. Production..... a. Good rustlers and extremely hardy under cold weather conditions b. Reputation as easy keepers and good gainers c. Produce meat of high quality
Hereford	A. Originated in Hereford County, England B. First imported to U.S. in 1817 to Kentucky by Henry Clay	1. Color..... Red bodies ranging from light to deep red. White faces, underline, flank, crest, switch, breast, and below knees and back. Red neck or white extending behind withers on back, too high in flanks or above knees and backs is objectionable

BREED

ORIGIN

CHARACTERISTICS

Hereford (Continued)

- 2. Horned
- 3. Size.....
 - a. Upstanding, large bones, muscled
 - b. Average Mature Weight:
 - (1) Male: 1200-1800 lbs.
 - (2) Female: 800-1000 lbs.
- 4. Sexual Maturity..
 - a. Male: 9-13 months
 - b. Female: 8-12 months
- 5. Temperament Very docile, easily handled and gentled
- 6. Production.....
 - a. Breeding Performance
 - (1) Easily adapted to hot and cold climates
 - (2) Good mothering ability
 - (3) Highly prolific (bulls and cows)
 - (4) High percentage birth rate
 - (5) Average birth weight
 - (6) Low to average milkers
 - (7) Average growth rate
 - (8) High percent weaning
 - b. Feeding Performance
 - (1) High feed conversion
 - (2) High daily rate of gain (growth rate)
 - (3) High live grade
 - c. Slaughter Performance
 - (1) High carcass grade
 - (2) Average to high dressing percent
 - (3) Average to high percent high priced cuts
 - (4) High percent marbling
 - (5) High tenderness (low shear force)

AgI-VI-21

BREED	ORIGIN	CHARACTERISTICS
Milking Shorthorn	A. Developed by Thomas Bates in England B. Bred for a dual-purpose type C. American farmers began developing herds as early as 1885.	1. Color.....Roan, other combinations of red and white 2. Originally horned, but polled strains have been developed. 3. Size..... a. Cattle tend to be of a larger frame and higher off the ground than common beef type b. Mature Weights: (1) Male: 2000-2500 lbs. (2) Female: 1400-18--lbs. 4. Temperament..... Inclined to be slightly nervous and flighty 5. Production..... a. Cows show good mammary development. b. Very competitive in beef producing qualities. c. Variation in type presents a problem in the showring.
Red Angus	A. The origin of the breed was in the British Isles, the same as the Black Angus. B. In England and Scotland both blacks and reds are registered in the same association without distinction. C. The Red Angus Association of America was organized in 1954.	1. Color..... Red Angus are homozygous for the red color and always breed true when mated to each other. 2. Polled 3. The general characteristics are similiar to those of the black cattle. 4. All animals must pass inspection before registration. 5. The breed maintains a high percentage of its cattle on production testing.

BREED	ORIGIN	CHARACTERISTICS
Red Angus (Continued)		
	D. In the U.S., red colored animals have been barred from registry in the American Angus Association	

Red Poll	A. Originated in England prior to 1800	1. Color..... Red; varying from light to dark red
	B. First imported by F. G. Faber in New York in 1873	2. Polled..... When bred to horned cattle have proven to be 95% to 100% dehorner
	C. Developed as a dual-purpose breed in their native counties	3. Size..... a. Medium sized breed b. Mature Weight (1) Male: 1900-2200 lbs. (2) Females: 1200-1700 lbs.
		4. Production..... a. Cows give an abundance of rich milk which produces high-quality beef. b. Calves meet requirements of the fat slaughter calf market or the feedlot. c. Cattle have reputation of producing high cutability carcasses. d. Cattle do quite well under less than favorable grazing conditions. e. Remarkably uniform in type and quality

Scotch Highland	A. Scotland	1. Color..... Silver, golden, light red, brindle, black, or dun.

BREED

ORIGIN

CHARACTERISTICS

Scotch Highland (Continued)

B. First impor-
tation to the
U.S. in 1883

2. Long, widespread horns and heavy foretop
3. Distinctive appearance with long, shaggy coats of hair
4. Able to withstand severe climates
5. Cattle exhibit a very nervous temperament under most conditions.

Shorthorn

A. Originated in north-
eastern England

B. First beef breed im-
ported to America by
Miller and Gough of
Virginia in 1783

1. Color..... Red, white, and roan; com-
binations of red and white;
nose flesh colored
2. Horned and polled
3. Size..... a. Smooth, upstanding
medium muscled
b. Average Mature Weight:
(1) Male: 1400-1700 lbs.
(2) Female: 900-1200 lbs.
4. Sexual Maturity.. a. Male: 9-13 months
b. Female: 8-12 months
5. Temperament..... Good disposition, easily
handled
6. Production a. Breeding Performance
(1) Adapted to cold and
warm climates
(2) High mothering ability
(3) Highly prolific
(4) High birth rate
(5) Average birth weight
(6) Good milkers
(7) High growth rate
(8) High % weaning rate

BREED

ORIGIN

CHARACTERISTICS

Shorthorn (Continued)

- b. Feeding Performance
 - (1) Average to high feed conversion
 - (2) Average daily rate of gain
 - (3) Average to high live grade
- c. Slaughter Performance
 - (1) Average to high carcass grade
 - (2) Average dressing %
 - (3) Average % high cuts of meat
 - (4) High % marbling
 - (5) High tenderness (low shear force)

Barzona

A. Developed at the Bard Kirkland Ranch in Arizona

1. Color..... Red

2. Horned

B. Name of breed comes from a combination of Bard and Arizona

3. Size..... Big, rugged cattle resulting from the crossing of Africander, Hereford, Angus and Santa Gertrudis breeds

4. Developed in an effort to produce an animal adapted to the harsh, arid conditions of the southwestern United States

5. Cattle exhibit loose skin characteristics typical of hybrid Africander breeding.

Beefmaster

A. Developed by the Lasater Ranch formerly of Falfurrias, Texas and now of Colorado

1. Color..... Red is the dominant color, is variable, and is disregarded in selection.

B. Established by Ed Lasater in 1908

2. Majority of cattle are horned, although a few are naturally polled.

BEEF

ORIGIN

CHARACTERISTICS

Beefmaster (Continued)

- | | |
|--|---|
| <p>C. Percentage blood or parent breeds of the Beefmaster runs about 25% Hereford, 25% Shorthorn, and 50% Brahman</p> <p>D. Unique breed in that each breeder affixes his name to his own strain of cattle, such as "Lasater Beefmasters".</p> | <p>3. Size..... Mature cattle are large in size.</p> <p>4. Production a. Cows are good producers under range conditions.
b. Weaning weights are used as a criterion for selecting replacements.
c. Good performance in feedlots has been achieved
d. Conformation is not considered important except as it relates to the production of red meat.</p> |
|--|---|

Brangus

- | | |
|--|---|
| <p>A. Developed on the Clear Creek Ranch in Welch, Oklahoma</p> <p>B. Crossings of Angus and Brahman cattle started in 1932.</p> <p>C. Registration requirements call for an animal of 5/8 Angus and 3/8 Brahman breeding.</p> <p>D. Breed association was formed in 1949.</p> | <p>1. Color..... Black</p> <p>2. Polled</p> <p>3. Size..... Among the larger of the beef breeds</p> <p>4. Characterized by a slight crest over the neck with a smooth, sleek hair coat.</p> <p>5. Cattle are known to produce a high quality carcass.</p> <p>6. Well adapted to the southwestern regions of the United States</p> |
|--|---|

Charbray

- | | |
|--|--|
| <p>A. Originated in the Rio Grande Valley in Texas</p> <p>B. The result of blending the Charolais and the Brahman breeds</p> | <p>1. Color..... Golden to white</p> <p>2. Horned</p> <p>3. Size..... a. A large very rugged breed
b. Mature Weight:
(1) Male: 2500-3200 lbs.
(2) Female: 1700-2000 lbs.</p> |
|--|--|

BREED

ORIGIN

CHARACTERISTICS

Charbray (Continued)

4. The hump of the Brahman is almost nonexistent, but evidence of a heavy dewlap remains.
5. Cows milk well and produce heavy weaning calves.
6. Cattle exhibit heavy muscling in the loin and quarters.

Polled Hereford

A. Originated by Warren Gammon of Iowa in 1902

B. Gammon purchased 11 polled mutations from various breeders from which the Polled Hereford was developed.

1. Color..... Red bodies ranging from light to deep red. White faces, underline, flank, crest, switch, breast, and below knees and backs. Red necks or white extending behind withers on back, too high in flanks, or above knees and backs is objectionable.
2. Polled..... Presence of horns or scurs is objectionable.
3. Size..... a. Upstanding, a little more compact than Herefords, muscle sometimes lighter in quarters than Hereford.
b. Mature Weight:
(1) Male: 1100-1600 lbs.
(2) Female: 800-900 lbs.
4. Sexual Maturity.. a. Male: 9-13 months
b. Female: 9-12 months
5. Temperament..... Very docile, easily handled and gentled.
6. Production..... a. Breeding Performance
(1) Easily adapted to hot or cold climates

BREED	ORIGIN	CHARACTERISTICS
Polled Hereford (Continued)		(2) Good mothering abilities (3) Highly prolific (bulls and cows) (4) High percentage birth rate (5) Average birth weight (6) Low to average milker (7) Average growth rate (8) High & weaning rate b. Feeding Performance (1) Average to high feed conversion (2) Average daily rate of gain (growth rate) (3) Average to high live grade c. Slaughter Performance (1) Average carcass grade (2) Average to high dressing percent (3) Average to high percent of high priced cuts (4) High percent marbling (5) High tenderness (low shear force)

Polled
Shorthorn

- | | |
|---|---|
| <p>A. Developed in the north central states of the U.S., chiefly Ohio and Indiana</p> <p>B. First referred to as Polled Durhams, but officially named Polled Shorthorns in 1919</p> | <p>1. Color..... Red, white, or any combination of red and white (roan)</p> <p>2. Polled..... A dominant characteristic</p> <p>3. Other characteristics are similar to the Shorthorn breed.</p> <p>4. Pedigrees also very similar to the horned Shorthorns.</p> |
|---|---|

AgI-VI-28

BREED	ORIGIN	CHARACTERISTICS
Red Brangus	A. Developed in the U.S. in 1946 on the Paleface Ranch at Spicewood, TX B. Results from crossing the Angus and Brahman breeds, but there are no requirements for any specific percentage for registration.	1. Color..... Red 2. Polled 3. Similiar to the Brangus in other body characteristics 4. Recognized for growth rate, efficiency of production, and carcass quality. 5. A desirable beef breed
Santa Gertrudis	A. Developed by the King Ranch, Kingsville, Texas B. Developed from crossing Braham and Short-horn cows; started in 1910. C. Breed is 5/8 Short-horn and 3/8 Brahman D. Breed name is derived from the Santa Gertrudis Land Grant by Spain which is now the headquarters division of the King Ranch	1. Color..... Red or cherry red; white or other spotting, fawn, cream or brindle color, black skin are disqualifications. 2. Horned..... Neck folds and sheath present 3. Size..... a. Large, loose hided, big bones, beef type b. Average Mature Weight: (1) Male: 1500-2000 lbs. (2) Female: 1000-1300 lbs. 4. Sexual Maturity.. a. Male: 12-15 months b. Female: 11-13 months 5. Temperament..... Active, not generally nervous, gentle natured when handled quietly 6. Production..... a. Breeding Performance (1) Adapted to warm or hot climates (2) Average mothering ability

BREED	ORIGIN	CHARACTERISTICS
Santa Bertrudis (Continued)		
		(3) Average prolificacy
		(4) Average birth rate
		(5) High birth weight
		(6) Good milkers
		(7) Average to high growth rate
		(8) Average % weaning rate
		b. Feeding Performance
		(1) Average feed conversion
		(2) Average daily rate of gain
		(3) Average live grade
		c. Slaughter Performance
		(1) Average carcass grade
		(2) Average dressing %
		(3) Average % high priced cuts
		(4) Low to average % marbling
		(5) Low to average tenderness (high shear test)

Crossbreeding:

The mating of animals of two purebred breeds produces the first cross offspring (F_1). The F_1 females possess hybrid vigor which means they are able to produce better than their parents. Weaknesses of a specific breed tend to be overcome in the use of crossbreeding. In second cross females, those produced by F_1 females, hybrid vigor is evident but reduced.

The use of purebred bulls in any breeding program gives the best results.

F_1 females can be mated to purebred bulls of either parent breed or to purebred bulls of a third breed.

The more distant related the two parent breeds are, the greater the hybrid vigor. Hereford X Angus would be more closely related (English breeds) than Hereford X Brahman (English and Zebu breeds).

BREED

ORIGIN

CHARACTERISTICS

Crossbreeding (Continued)

The weaker a trait in a breed the greater the improvement through crossbreeding of this trait. A cow of one breed which weans 300 lbs. of beef x a bull which averages 400 lbs. may produce an F_1 cow who will wean 410 lbs. of beef. Whereas, a cow of a different breed which weans 400 lbs. of beef x the bull that averages 400 lbs. of beef weaned may produce an F_1 cow that weans 430 lbs. of beef. The increase is greater in the first case.

Good purebred herds are a necessity in producing F_1 females for crossbreeding programs.

Blond D'Aquitaine A. Southern France

1. Color..... Fawn colored, varying from wheaten to slightly red; the hair is short and soft.
2. Horned
3. Size..... a. Mature Weight:
 - (1) Male: approximately 2500 lbs.
 - (2) Female: approximately 1500 lbs.
4. Formerly valued as a draft animal as well as for meat and milk production.
5. Heavily muscled body with a deep chest, wide hips, and well-developed, muscular hind-quarters.

Chianina

- A. Originated in the Chianina Valley in Central Italy
- B. Said to have been the sacrificial cattle of the ancient Romans

1. Color..... White
2. Horned
3. Size a. Reputed to be the largest of all beef breeds.
 - b. Cattle stand five and a half feet high at the withers.

BREED

ORIGIN

CHARACTERISTICS

Chianina (Continued)

c. Mature Weight:

(1) Male: 2500-1800 lbs.
with some up to 4000
lbs.

(2) Female: 1700-2100 lbs.

4. Until recently were used for draft stock as well as for beef.

5. Conformation..... a. Structurally, they exhibit excellent uniformity of body depth, trimness of middle, and absence of excessive dewlap and brisket.
b. Strong legs and hard hooves have been developed through the centuries of selection for work.

Gelbvieh

A. Native to Austria and the Bavarian region of West Germany

1. Color..... Varies from a light tan or yellow to a light red

2. Horned

B. Gelbvieh literally means "yellow cattle."

3. Size..... Mature Weight:
(1) Male: 2200-2400 lbs.
(2) Female: 1400-1800 lbs.

4. Cattle have been developed as a tri-purpose animal, for draft as well as for milk and meat.

5. Excellent beef conformation

Hays Converter

A. Developed in Canada by the former Minister of Agriculture, Senator Harry Hays

1. Color..... Usually black with a white face, although there are a few red or red with a white face.

AEI-VI-32

BREED

ORIGIN

CHARACTERISTICS

Hays Converter (Continued)

- | | |
|--|---|
| B. Foundation stock of Hereford-Brown Swiss hybrids being crossed with Hereford-Holstein hybrids | 2. Horned and polled |
| C. A combination of these two F ₁ hybrids were interbred to produce. | 3. Developed to produce a fast-growing, good-milking gype of cattle, combining desirable traits from beef and dairy herds |
| | 4. Good rustlers and raise a good calf as a result of their genetic ability for hardness, growth, and increased milk. |

Limousin

- | | |
|---|--|
| A. Originated in south central France | 1. Color..... Wheat-colored, ranging from reddish to light yellow |
| B. Developed for draft and beef | 2. Predominately horned but there are a few polled cattle. |
| C. First Limousin bull imported to the North American continent in 1967 | 3. Size..... Mature Weight:
(1) Male: approximately 2400 lbs.
(2) Female: approximately 1300 lbs. |
| | 4. Excellent body conformation
a. Long body with good length of loin
b. Hindquarters are heavily muscled and carry well down to the hocks. |
| | 5. High growth rate |
| | 6. Cows are very productive, fertile, and good milkers. |

Lincoln Red

- | | |
|--|--|
| A. Descending from the Shorthorn breed | 1. Color..... Deep cherry red with medium thick hair |
| | 2. Horned, but a large percentage of animals are polled. |

BREED

ORIGIN

CHARACTERISTICS

Lincoln Red (Continued)

B. Developed as a distinct breed in the Lincolnshire area of England for well over a century

3. Size..... Mature Weight:
 (1) Male: 1800-2000 lbs.
 (2) Female: approximately 1400 lbs.
4. Formerly recongized as a dual-purpose breed that now largely bred for beef
5. Cattle are long-bodied, deep-chested, and well-muscled.

Maine-Anjou

A. Developed in France

B. Resulted from crossing native Mancelle cattle of Brittany with imported English Shorthorns

1. Color..... Animals vary from red bodies with white markings to dark roan; a red coat color is favored by most French breeders.
2. Horned
3. Size..... a. Described as probably bigger than any other French breed
 b. Mature Weight:
 (1) Male: approximately 2400 lbs.
 (2) Female: 1400-1600 lbs.
4. Used for meat and milk with emphasis on beef
5. Conformation..... a. Cattle are long-bodied and rather upstanding with a long rump
 b. Heavy muscled body of typical beef conformation.
6. Average milk production is about 5,000 lbs. per lactation.

BREED	ORIGIN	CHARACTERISTICS
Marchigiana	A. Native to the central part of Italy	1. Color..... Gray 2. Horned 3. Size..... a. Cattle are large. b. Mature Weight: (1) Male: up to 2650 lbs. (2) Female: 1350-1500 lbs. 4. Formerly used for draft as well as for beef producers. 5. Considered quite efficient as beef producers 6. Resemble the Chianina in some ways
Murray Grey	A. Originated in Australia in 1906 B. Developed by crossing an extremely light roan Shorthorn cow with an Aberdeen Angus bull. During her lifetime, the Shorthorn cow had 12 calves, which were all dun gray, from Angus matings. It was from her bull calves that the breed descended.	1. Color..... Silver gray with a black pigment in the skin 2. Polled 3. Size..... Mature Weight: (1) Male: one ton or more (2) Female: 1300-1500 lbs. 4. Much like the Angus in type. 5. Animals produce a very desirable carcass. 6. Reputation for easy calving; calves weigh 60-70 lbs.
Piedmont	A. Originated in northwestern Italy	1. Color..... Grayish-white body with darker gray or black about the head, neck, and shoulders, often encircling the eyes; the nose, hooves, and switch are black. 2. Horned

BREED

ORIGIN

CHARACTERISTICS

Piedmont (Continued)

3. Conformation.....
 - a. Double muscling is a selected trait, and it is evident in the bulging hindquarters.
 - b. Results from the Italians selecting and breeding for more red meat.
 - c. Breeders of these cattle claim a carcass cut-out or 75% meat.
4. Fertility and ease of calving are factors relating to the success of the Piedmont in a crossing program.

Pinzgauer

A. Originated in Australia and the adjacent areas of the Federal Republic of Germany and Italy

1. Color..... Chestnut brown with a variety of white marks on the back, the rump, and along the underline.
2. Horned
3. A dual-purpose for both meat and milk production
4. Fertility and longevity have been emphasized with fertility reaching about 91%.
5. Conformation.....
 - a. A long barrel with good width and depth through the chest and hips is desirable.
 - b. Cattle possess a lean but beefy type muscling with thick, wide loins.
 - c. Noted for soundness of feet and legs for excellent ranging ability.
6. Average 305-day milk production about 9,000 lbs. with a 4% fat content.

BEEF

ORIGIN

CHARACTERISTICS

Pinzgauer (Continued)

7. Produces a high quality meat which is light-colored and has a fine grain.
8. Slaughter calves produce excellent weight gains on feed tests.

Simmental

- A. Originated in the Simme Valley of Switzerland
- B. From there the breed has spread to most of the continents
- C. The predominant breed in Europe today, numbering over 35 million head
- D. In France, the cattle are called "Pie Rouge," while in Germany they are called "Fleckvieh."

1. Color..... Generally red and white spotted, although some are solid in color; a white face appears to be dominant in inheritance (as in the Hereford); red varies from dark to almost yellow in shade.
2. Horned
3. Size..... Mature Weight:
(1) Male: up to 2600 lbs.
(2) Female: 1400-1800 lbs.
4. Originally developed for milk, meat, and draft, but now much in demand for beef.
5. Conformation..... a. Long bodied
b. Relatively heavy-boned
c. Well muscled
6. Cows are good milkers.
7. In feedlot, comparable to the Charolais in growth.

Sussex

- A. Originated in England
- B. Developed strictly as a beef breed

1. Color..... Deep cherry red with a white switch
2. Horned..... Polled factor has been introduced.

BREED	ORIGIN	CHARACTERISTICS
Sussex (Continued)		3. Size..... Mature Weight: (1) Male: 2000 lbs. or more (2) Female: approximately 1400 lbs. 4. Conformation..... a. Long, cylindrical body b. Straight back with well sprung ribs c. Wide loins and broad hind-quarters 5. The breed offers maximum hybrid vigor in crossing, with crosses having a better performance than purebreds.
Welsh Black	A. Recognized as the oldest British breed B. Reports of these cattle from the hills of Wales as early as 1300 C. A long history of usefulness for draft, milk, and beef production	1. Color..... Black with a shaggy winter coat 2. Horned 3. Size..... Compares with the Devon 4. Noted for hardiness 5. Make good use of sparse grazing 6. Ability to withstand unfavorable weather conditions

BREED REGISTRY ADDRESSES

Standard Breeds

Angus	American Angus Association 3201 Frederick Boulevard St. Joseph, MO 64501
Brahman	American Brahman Breeders Assn. 1313 La Concha Lane Houston, TX 77054
Brown Swiss	Brown Swiss Cattle Breeders Assn. Box 1038-A Beloit, WI 53511
Charolais	American-International Charolais Association 1610 Old Spanish Trail Houston, TX 77054
Devon	American Devon Cattle Club, Inc. P.O. Drawer 628 Uvalde, TX 78801
Galloway	Galloway Breeder's Assoc. 302 Livestock Exchange Bldg. Denver, CO 80216
Hereford	American Hereford Association 715 Hereford Drive Kansas City, MO 64105
Milking Short- horn	American Milking Shorthorn Society 1722 - JJS. Glenstone Springfield, MO 65804
Red Angus	Red Angus Association of America P.O. Box 776 Denton, TX 76201
Red Poll	Red Poll Cattle Club of America 3275 Holdredge Street Lincoln, NB 68503
Scotch Highland	American Scotch Highland Breeders Assn. 508 Main St. Walsenberg, CO 81089
Shorthorn	American Shorthorn Association 8288 Hascall Street Omaha, NB 68124

Breed Registry Addresses
(Continued)

Breeds of American Origin

Barzona	Barzona Breeders Association of America P.O. Box 9 Kirkland, AZ 86332
Beefmaster	Foundation Beefmaster Association 201 Wyandot Street Denver, CO 80223
Brangus	International Brungus Breeders Association 9500 Tioga Dr. San Antonio, TX 78230
Charbray	American Charbray Breeders Association 475 Texas National Bank Building Houston, TX 77002
Polled Hereford	American Polled Hereford Association 4700 E. 63rd Street Kansas City, MO 64130
Polled Shorthorn	American Polled Shorthorn Society 8288 Hascall St. Omaha, NB 68124
Red Brangus	American Red Brangus Association 404 Colorado Austin, TX 78701
Santa Gertrudis	Santa Gertrudis Breeders International Association P.O. Box 1257 Kingsville, TX 78363

Exotic Breeds

Blond D'Aquitaine	Blond D'Aquitaine Society of America P.O. Box 250 Stillwater, MN 55082
Chianina	American Chianina Association P.O. Box 11537 Kansas City, MO 64138
Gelbvieh	American Gelbvieh Association Route 1, Box 126 Newkirk, OK 74647
Hays Converter	Hays Converter c/o Senator Harry Hays Calgary, Alberta, CANADA

Breed Registry Addresses
(Continued)

Limousin	North American Limousin Foundation 100 Livestock Exchange Building Denver, CO 80216
Lincoln Red	Canadian Lincoln Red Association c/l J.G. Lorrigan Box 447 Richmond Hill, Ontario, CANADA
Maine-Anjou	American Mair-Anjou Association 564 Livestock Exchange Bldg. Kansas City, MO 64102
Marchigiana	Marchigiana (Breed Registry Association not known)
Murray Grey	American Murray Grey Association, Inc. Box 30085 Billings, MT 59101
Piedmont	Piedmont (Breed Registry Association not known)
Pinzgauer	American Pinzgauer Association P.O. Box 1003 Vorman, OK 73069
Simmental	American Simmental Association Simmental Way Bozeman, MT 59715
Sussex	Sussex (Breed Registry Association not known)
Welsh Black	Canadian Welsh Black Cattle Society Taber, Alberta, CANADA

BREEDS OF LIVESTOCK

TEST

1. Match the terms on the right with the correct definition.

- | | |
|--|--|
| _____ a. A family or family line of breeding | 1. Crossbred breeder |
| _____ b. The male of the bovine species (cattle) | 2. Purebred breeder |
| _____ c. Removal of the testicles of a male animal | 3. Artificial breeding or insemination |
| _____ d. A breeder of animals of the commercial markets | 4. Bloodline |
| _____ e. Depositing the male semen into the reproductive tract by artificial means | 5. Bull |
| _____ f. An animal of the bovine species under one year of age and any sex | 6. Calf |
| _____ g. A breeder of animals whose ancestors are all of the same breed (may or may not be pedigreed) | 7. Castration |
| _____ h. A table presenting a line of ancestors for an animal | 8. Commercial breeder |
| _____ i. A male bovine animal that has been castrated at an early age | 9. Cow |
| _____ j. A breeder of livestock producing animals that are the offspring of animals of two different purebreds | 10. Full-blood |
| _____ k. A female of the bovine species that shows evidence of having produced one or more calves | 11. Heifer |
| _____ l. A purebred animal | 12. Springer |
| _____ m. A cow showing signs of pregnancy | 13. Pedigree |
| _____ n. A female bovine that has not borne an offspring | 14. Steer |

2. Describe the major breeds of beef cattle given below by including origin, characteristics, and reason for selecting this breed over another breed.

Breed	Origin	Characteristics	Selection Reasons
a. Hereford			
b. Charolais			
c. Brahman			
d. Angus			

BREEDS OF LIVESTOCK

ANSWERS TO TEST

1. a. 4
- b. 5
- c. 7
- d. 8
- e. 3
- f. 6
- g. 2
- h. 13
- i. 14
- j. 1
- k. 9
- l. 10
- m. 12
- n. 11

2. Breed	Origin	Characteristics	Selection Reasons
a. Hereford	England	Red with white face, underline, crest, and switch; horned	
b. Charolais	France	White to cream, horned, large, heavy muscled animal.	
c. Brahman	India; Texas	Light gray to dark red, drooping ears, long face; prominent hump over shoulders, loose skin, tolerant to parasites and insects, excellent foragers, resistant to eye diseases, adapted to hot, arid climates	
d. Anugs	Scotland	Black, polled, resistant to eye disease, excellent carcass ability	

STUDENT CLASSROOM ACTIVITIES

1. List the names of the beef breeds developed in the United States which have Brahman blood in the background and also give the approximate percent of Brahman blood.

BreedPercent of Brahman blood

- a.
 - b.
 - c.
 - d.
 - e.
2. Which of the British beef breeds was the first to be introduced into the United States and in what year?
 3. Mention was made of cattle that have been developed as tri-purpose animals. What are the three uses of a tri-purpose animal?
 - a.
 - b.
 - c.
 4. Write the names of the so-called "exotic breeds" that you have seen as a live animal.
 5. Which of the following traits in cattle is dominant and which is recessive?
Horned -
Polled -
 6. List the names of the beef breeds that were developed in Texas.
 - a.
 - b.
 - c.
 7. Select one "standard" and one "exotic" breed of your choice and write to the breed registry association for additional information and picture.

STUDENT CLASSROOM ACTIVITIES (Continued)

8. Write the name of the beef breed in the space that is provided for each description given below.

_____ The percentage blood of the parent breeds of these cattle is about 25% Hereford, 25% Shorthorn, and 50% Brahman.

_____ The foundation stock used in developing this breed was Hereford, Brown Swiss, and Holstein.

_____ This black, naturally polled breed originated in Scotland.

_____ This breed of French origin is white or light straw-colored.

_____ Often considered the "American Exotic," this breed is one of the largest and most heavily muscled of all dairy breeds.

_____ These cattle are smaller in size than the traditional beef breeds and are commonly known as "Red Rubies."

_____ These horned cattle vary in color from a medium to a dark red with white faces, white crest, and white on the dewlap, underline flanks, switch, and lower parts of the legs.

_____ Long curly black hair with a mossy undercoat is characteristic of this polled breed.

_____ Big, rugged, red, horned cattle that were developed in Arizona.

_____ Fawn-colored horned cattle that originated in southern France

_____ White, horned cattle from Italy which are reputed to be the largest of all beef breeds.

_____ These predominantly horned cattle are wheat-colored, ranging from reddish to light yellow, and originated in south central France.

_____ This breed of Australian origin is characterized by a silver gray color.

_____ Described as the largest of the French-bred cattle and varying in color from red bodied with white markings to dark roan.

_____ Naturally hornless strain of "Whiteface" cattle developed by Warren Gammon of Iowa.

_____ A breed developed in the British Isles which are red in color due to a homozygous recessive gene condition.

_____ Large, gray, horned cattle which are native to the central part of Italy.

Developed in the U.S. From several strains of "Zebu" cattle which were imported from India, these cattle occupy a unique position in commercial crossbreeding.

Native to Austria and West Germany, these "yellow cattle" were developed for draft, milk, and meat.

Deep red-colored cattle which are descendants of the Shorthorn and were developed in the Lincolnshire area of England.

A breed of Italian origin which are grayish-white in color with dark gray or black about the head, neck and shoulders.

A breed of cattle, which are red in color, resulting from Brahman-Angus crosses.

The predominant breed in Europe today: generally fawn to red-and white-spotted in color.

Native to Scotland, these cattle are characterized by long, widespread horns and a shaggy coat of coarse outer hair with an undercoat of short hair.

Recognized as the oldest British breed, these cattle are horned and have a black shaggy winter coat.

The first of beef breeds introduced into the U.S.; they may be red, white, or any combination of these colors.

The basic color of this breed from Austria and Germany is chestnut brown, with a variety of white marks on the back, the rump, and along the underline.

These cattle of English origin are a deep cherry red in color with a white switch.

These cattle, developed by the King Ranch, are a cherry red in color and result from a 5/8 Shorthorn-3/8 Brahman cross.

These cattle were developed in Oklahoma from a blending of the Brahman and Angus breeds.

Medium-sized, naturally polled cattle that are light to dark red in color and were imported into the United States from England prior to 1880.

STUDENT CLASSROOM ACTIVITIES (Continued)



9. Cross Word Puzzle

ACROSS

5. Horned, "white-faced" cattle
7. French origin - cross between Mancelle and English Shorthorn breeds
11. Controlling gene
13. Largest of the beef breeds
14. A group of animals having a common ancestry
15. "Ruby Reds"
18. New imported European breeds
20. Animals bred and used as work stock
21. Naturally polled, black cattle originating in Scotland.
24. Big, white breed of cattle originating in France
25. Two F₁ hybrids were interbred to produce the _____ Converter.
28. Breed resulting from a Shorthorn-Brahman cross
29. Not polled

DOWN

1. Italian breed selected for double muscling
2. Black breed developed in Oklahoma by crossing Angus and Brahman
3. Hornless
4. Often considered the "American Exotic"
6. Inherited trait causing abnormal muscle development (two words)
8. The American Brahman breed was developed from cattle imported from this country.
9. The "British Breeds" originated in this country.
10. Wheat-colored breed developed in south central France.
12. Cattle with a prominent hump over the shoulders

Cross Word Puzzle (Continued)

DOWN

16. Literally means "yellow cattle"
17. Predominant beef breed in Europe
19. Welsh Black is the oldest _____ breed.
22. Cherry red in color with white switch.
23. Breed developed in Arizona.
26. Gray cattle originating in Australia (two words)
27. First British breed introduced into the United States.
30. _____ is the dominant color of the Beefmaster.
31. _____ is the characteristic Galloway color.

Instructor's Guide
Beef Management Information

The following information may be needed by freshmen students as a basis to begin their beef projects. This information should be made available to all students to aid them with their projects. This is not intended to be a complete management unit; however, it does represent basic facts and rules of thumb.

Beef Cattle ManagementA. Breeding

1. Have bulls' fertility checked before the breeding season.
2. If pasture breeding:
 - 10-20 cows per yearling bull
 - 20-30 cows per 2 year old bull
 - 30-40 cows per mature bull
3. Have a 60 day breeding season and then remove bulls.
4. Start breeding heifers one cycle sooner than older cows.
5. Pregnancy test all cows and heifers 60 days after end of breeding season.
6. Sell open cows and heifers.

B. Replacement Heifers

1. Approximately 15% of mature cow herd will need to be replaced each year due to death, breeding failures and old age. Therefore, 30-40% of heifer calves will need to be selected as possible replacements.
2. Select replacement heifers on basis of performance records.
3. Heifers should be fed to gain 0.75 to 1.25 pounds per day from weaning until calving at 24 months of age.
4. British breed heifers (e.g. Angus or Hereford) should weigh 575 to 700 pounds at the breeding time of 15 months.

C. Nutritional Requirements for the Cow Herd

1. Consult the NRC (National Research Council) publication "Nutrient Requirements for Beef Cattle" for specific requirements.
2. Be sure that cattle have an adequate supply of fresh, clean water at all times. Cows need from 8 to 15 gallons per head per day.
3. Provide cows a good free choice mineral-vitamin mix.
4. Supply plenty of high quality forage throughout the pasture season.
5. Follow a well-planned forage program using rotation grazing when possible.

6. Wintering beef cows:
 - a. Goal: keep feed costs low and still meet nutrient needs of the cow.
 - b. Use crop residues whenever possible.
 - c. Make certain that low quality forages are properly supplemented with protein, vitamins, and minerals.
 - d. Wintering gains: (Spring calving)
 - 1) replacement heifers - 1 pound per day gain first winter
 - 2) young cows and thin cows: 0.5 lb. per day first winter
 - 3) older, mature cows - maintain their fall weight. Can lose 10-15% of their fall weight through calving.
7. Feeding recommendations:
 - a. Mature cows, nursing calf, during breeding season

total air dr feed	= 26 lb.
crude protein	= 2.2 lb.
TDN	= 13.7 lb.
 - b. Mature cow, dry, pregnant

total air dry feed	= 18 lb.
crude protein	= 1.0 lb.
TDN	= 8.8 lb.

D. The Feedlot

1. Space requirements:

Open feedlot (Lot area sq. ft./head)

 - 400 - unsurfaced lot (may vary depending upon climate)
 - 150 - lot partially surfaced (includes indoor feeding with outdoor resting)
 - 55 - lot surfaced, no shelter
 - 30 - lot surfaced with open housing

Feeding space per animal

 - a. When all animals eat at once:

calves to 600 lbs.	- 20"
yearlings	- 24"
cows	- 28"
 - b. When feed always available:

hay or silage	- 4 to 6"
grain & supplement	- 3 to 4"
grain & silage	- 6"
2. General feeding recommendation:
 - a. Growing period:

steers	- 400 to 750 lbs.
heifers	- 400 to 650 lbs.

total daily feed requirement - 3.0%
of body weight.
protein level required - 11.12% of
total ration

- b. Finishing period:
steers - 750 lbs. to market at 1050-
1100 pounds
heifers - 650 lbs. to market at 925-
975 pounds
total daily feed requirement - 2½% of
body weight
protein level required = 10.5% of total
ration

E. How efficient are beef in the use of feed:
AVERAGE FEED EFFICIENCY Beef: 7-8# feed per 1# gain

F. What factors besides physical and production characteristics should be considered when selecting a breed?

1. Adaptability of the breed
Adaptability of the breed refers to how well the breed will adapt to the existing situation or environment on the farm or ranch. Environmental conditions are an important consideration when selecting a breed.
2. Availability of the breed
If there are few animals of the desired breed in the local area, a farmer or rancher will have to travel long distances to obtain stock. This could result in higher initial costs for the breeding stock.
3. Purpose for which animals will be used.
Certain breeds of animals do better on range than others. In sheep, some breeds produce better quality wool than do other breeds. A decision as to the type of production desired must be made before a breed is chosen.
4. Personal likes
Unless other conditions make it inadvisable to select a breed of personal choice, this factor should be given due consideration before making a decision relative to selecting breeding stock.

G. What are the factors to be considered in the selection of individual animals?

One of the primary purposes of livestock selection is to select individuals possessing desirable traits which may be passed on to their offspring.

Weight

Weight at a given age is one indication of size

and growthiness of an animal. It is greatly influenced by condition or fatness.

General appearance

Type is the appearance of the animal and how closely it comes to the ideal of its class.

Size for age is important because rapid growth is economical and early maturity is desired.

Symmetry is the blending of the different parts of an animal in such a way as to make it useful, attractive, and stylish.

Sex character and temperament

In a breeding class the male should be dominantly masculine and the female definitely feminine. Masculinity refers to refinement of bone and a mild and retiring expression. A temperament that is calm and gentle is desired in farm animals; nervous or vicious individuals should be avoided.

Breed type

An animal should have the accepted standard characteristics of its breed with respect to conformation, color, and other distinguishing features.

Conformation

Conformation is the form or build of an animal as determined by the shape of its various parts

Condition

In market livestock condition and finish denote fatness. An animal in good breeding condition shows good flesh but is not overly fat nor too thin.

Quality

General quality is shown by fine hair, pliable skin, smooth hard bone, and general smoothness even when an animal is thin.

Quality of flesh refers to firm yet mellow flesh on an animal.

Substance

Substance refers to size of bone, size of frame, and amount of muscling.

Soundness

Soundness indicates freedom from irregular or abnormal body parts caused by disease, accident, or heredity.

Feet and legs

Feet and legs must be strong and straight with

ample bone. The action should be free and easy.

Body capacity

Relatively large in proportion to size of animal, providing ample capacity, strength, and vigor.

Barrel. Strongly supported, long and deep, ribs highly and widely sprung; depth and width of barrel tending to increase toward rear.

Heart girth. Large and deep, with well sprung fore ribs blending into the shoulders; full crops; full at elbows; wide chest floor.

Mammary system

A strongly attached, well-balanced, capacious udder of fine texture indicating heavy production and a long period of usefulness.

Udder. Symmetrical, moderately long, wide and deep, strongly attached (fore and rear), showing moderate cleavage between halves, no quartering on sides; soft, pliable, and well collapsed after milking; quarters evenly balanced.

Fore udder. Moderate length, uniform width from front to rear and strongly attached.

Rear udder. High, wide, slightly rounded, fairly uniform width from top to floor, and strongly attached.

Teats. Uniform size, of medium length and diameter, cylindrical, squarely placed under each quarter, plumb, and well spaced from side and rear view.

Mammary veins. Large, long, tortuous, branching

H. What are pedigree records?

A pedigree is a written record of an animal's ancestry kept to provide information by which an estimate of an animal's producing and transmitting ability can be made. To be of maximum value, it must contain all available production information on the animal it represents.

The record of ancestry is a list of those animals, such as the sire, dam, grandsires, and granddams, related to an animal through descent.

I. How are pedigree and production records used in the selection of livestock?

In buying breeding stock it is highly desirable

to look at an animal's ancestry for additional information that might indicate the potential performance of that individual.

One of the primary purposes of livestock selection is to select individuals possessing desirable traits which may be passed on to their offspring.

J. What are the major points to consider when judging beef breeding cattle?

Weight

General appearance

Type. Growthly, long bodied (particularly in rear quarters), heavily muscled, ample bone, moderate length of leg, trim.

Size for age. Large, rugged; proper height, width, and depth for age and breed. Under-sized or stunted animals to be avoided.

Symmetry. Straight top line, tight frame, heavy muscling in both fore and rear quarters, well-balanced, stylish

Sex character and temperament. Cows and heifers -- feminine in appearance; refined head and horn. Mild and matronly expression. Neck free from crest. Temperament, active and vigorous but gently. Bulls - masculine in appearance, massive head. Bold expression. Pronounced crest on back. Heavy bone structure. Temperament, active and vigorous.

Breed type. Color, shape of body, head and horn or poll characteristic of breed; proper size.

Conformation

Head. Appropriate for size of body; alert carriage; moderate length of face with slight dish; wide muzzle; bright eye; prominent poll; medium sized ears.

Neck. Moderate length and thickness; tapering evenly and uniformly from shoulder to head; light crest and dewlap.

Shoulder. Slight thickness with evidence of muscling, without being coarse.

Forearm. Prominently muscled

Brisket. Neat, trim, free from excess fat.

Chest and heart girth. Wide, good spring of ribs, moderate depth

Crops and ribs. Slight tapering from shoulder to forerib

Back and loin. Moderately thick; turn over the top should be rounded in appearance when view-

ed from behind, not square

Flanks. Slightly cut up, free from excess fat

Rump. Wide, long, level, heavily muscled; free from patchiness around tailhead

Rounds. Long as viewed from the side; thick, bulging muscling with widest point through the center of the round

Twist. Slightly cut up; depth not due to excess fat

Legs. Moderate length, straight, set squarely, wide apart, heavy bone

Condition

Good breeding condition; not excessively fat; evidence of thick natural fleshing

Quality

Freedom from coarseness; hair coat shows bloom

Feet, legs, and action

Feet of ample size and depth; action free and easy

K. What are the major points to consider when judging market cattle?

Weight

To meet market requirements

General appearance

Type. Growthy, long bodied (particularly in rear quarter), heavily muscled, ample bone, moderate length of leg, trim

Size for age. Large for age

Symmetry. Straight top line, tight frame, heavy muscling in both fore and rear quarters, well-balanced, stylish

Conformation

Head. Appropriate for size of body; alert carriage; moderate length and width; bright eye

Neck. Moderate length and thickness; tapering evenly and uniformly from shoulder to head; light crest and dewlap

Shoulder. Slight thickness with evidence of muscling, without being coarse

Forearm. Prominently muscled

Brisket. Neat, trim, free from excess fat

Chest and heart girth. Wide, good spring of ribs, moderate depth

Crops and ribs. Slight tapering from shoulder to forerib

Back and loin. Moderately thick; turn over the top should be rounded in appearance when viewed from behind, not square

Flanks. Slightly cut up, free from excess fat

Rump. Wide, long, level, heavily muscled; free from patchiness around tailhead

Rounds. Long as viewed from the side; thick, bulging muscling with widest point through the center of the round

Twist. Slightly cut up; depth not due to excess fat

Legs. Moderate length, straight, set squarely, wide apart, heavy bone

Condition

Covering. Finished with firm, uniform covering over ribs, back, loin, and rump but not excessively fat. Free from excess fat in brisket, flanks, and twist

Quality

Features. Freedom from coarseness and patchiness

Hair. Shows bloom

Skin. Loose, pliable, thin to medium thickness; no excess throat or dewlap

Bone. Large or heavy without being coarse

L. What are market classes and grades of livestock?

1. Market classes

Market classes are based upon the use of the animals. The market class is determined by all of those factors affecting the use and value of an animal, except the final grade. Example of market classes are as follows:

<u>Class of Animals</u>	<u>Market Classes</u>
Cattle	Slaughter cattle Stocker and feeder cattle Milkers and springers
Calves	Vealers Slaughter calves Stocker and feeder calves
Sheep	Slaughter sheep Feeding sheep Breeding sheep

<u>Class of Animals</u>	<u>Market Classes</u>
Lambs	Slaughter Feeder lambs Shearer lambs
Hogs	Slaughter hogs Feeder hogs

2. Market grades

Market grades are a measure of how well the animal fulfills the requirements for the class. The market grade is determined by the conformation, finish, and quality of the animal. Examples of market grades are as follows:

<u>Cattle</u>	<u>Calves</u>	<u>Lambs</u>	<u>Sheep</u>	<u>Hogs</u>
Prime	Prime	Prime	Choice	U.S. No. 1
Choice	Choice	Choice	Good	U.S. No. 2
Good	Good	Good	Utility	U.S. No. 3
Standard	Standard	Utility	Cull	U.S. No. 4
Commercial	Utility	Cull		Utility
Utility				
Cutter				
Canner				

M. How is carcass evaluation used in selecting livestock?

When judging market livestock we are trying to pick the animal which will produce the best carcass and thus bring in the greatest dollar returns.

A correlation between the carcass and the live animal can be determined by first judging animals on the hoof, and then evaluating the carcasses of the same animals. However, this correlation can also be used when judging livestock which are not to be slaughtered immediately. The condition (finish and muscling) of the animal at market time is a good indication of how that animal will grade. Abundant finish indicates excess fat and will tend to lower the cutability or yield of an animal as will not enough finish.

A thorough understanding of the location and relative importance of wholesale cuts will greatly aid in the evaluation of the points on a live animal and thus is of great value in judging livestock on the hoof.

N. What is dressing percentage?

Dressing percentage is the percentage of yield of chilled carcass in relation to the weight of the live animal.

O. What is a typical beef dressing percentage?

	<u>Average Live Weight</u>	<u>Dressed Weight</u>	<u>Dressing Percentage</u>
Cattle	950-1050#	570-630#	60.00%
Calves	200-255 #	110-140#	55.00%

P. What is the relationship between grade and price?

The higher an animal grades (quality) the higher the price that will be obtained on the market. However, this price is not always the same for animals within any one particular quality grade. Price is also based on cutability or yield. There may be as much as \$100 difference in value of carcasses of the same quality grade due to the yield of wholesale cuts.

To help identify these differences, USDA yield grades for beef have been developed in addition to the market (quality) grades. The two major things that determine cutability or yield grade are fatness and muscling. The best indicators of fatness are thickness and fullness over the back and in the flanks and brisket. Good indicators of muscling are thickness, plumpness of rounds and forearms.

There are five USDA yield grades for beef, numbered 1 through 5 within each market grades. For example, there can be yield grades of 1,2,3,4, or 5 within Prime, Choice, Good, etc. Yield Grade 1 carcasses have the highest yields of retail cuts; Yield Grade 5, the lowest. A carcass which is typical of its yield grade would be expected to yield about 2.3% more in retail cuts than the next lower yield grade, when USDA cutting and trimming methods are followed.

There are also similar yield grades for lambs. Yield grades for swine have not been established as a separate system; the market (quality) grades for swine also indicate the cutability in pork carcasses.

Q. How can yield grades be used by the livestock producer?

When used in conjunction with market (quality) grades, yield grades can provide a means to identify breeding and slaughter cattle for difference in yields of wholesale cuts. They also provide the producer with a valuable tool in selecting breeding stock and in planning and operating the most efficient production, feeding, and marketing program. Properly used, yield grades can bring about more efficiency in production and marketing and thus increase profits.

R. What happens to feeding efficiency and profitability when a feeder attempts to raise the grade of a stocker animal in the feedyard?

The most efficient feeding operation and greatest profit is realized when an animal is finished out at the same grade at which it was bought.

For example, the greatest efficiency is obtained by finishing out "good" calves to grade "good" at the slaughter house.

It is sometimes possible to finish out "good" calves to grade "choice" at the slaughter house but feed efficiency will drop and the profit margin will be lower than if the calves were not raised a grade. Animals are born with the muscling potential that they will have for life. If this muscling potential is lacking, there is no way in which feeding can add to evident muscling and thus raise the grade of an animal.

S. What economic trends influence the selection of livestock?

The consumer tends to dictate what the stockman should produce. Milk, low in butterfat, is desired by the consumer, also the demand for butter has dropped; therefore the dairyman looks for animals which produce large quantities of milk that is low in butterfat.

The consumer wants lean red meat and will not pay for fat therefore the livestock producer selects his animals so that they will reach the market in the form of tender, juicy, lean, cuts of meat.

BEEF COW MANAGEMENT CALENDAR
(for March-May calving herds)

JANUARY

- _____ Spray for lice
- _____ Watch cow herd for evidence of abortions
- _____ If cow herd is on a poorer quality roughage (corn stalks) consider feeding hay or grain
- _____ In extremely cold weather provide shelter in some form (building or windbreak)
- _____ Attend a cattle meeting and read farm magazines to keep current on the beef business

APRIL

- _____ Continue to watch for calving difficulty
- _____ Check semen of bull
- _____ Feed magnesium oxide (MgO) to prevent grass tetany
- _____ Check your pasture and forage program for balance with your beef program
- _____ Purchase bulls with good type and performance information on the traits you need

FEBRUARY

- _____ Separate heifers and cows
- _____ Increase feed to heifers
- _____ If on corn stalks, feed grain plus supplement or legume hay with minerals and vitamins.
- _____ Check breeding records to determine expected calving dates
- _____ Purchase ear tags and tattooing supplies
- _____ Check bull test station records for potential bull purchases
- _____ Move heavy springers to convenient calving pastures

MAY

- _____ Vaccinate all open cows and heifers for Vibriosis and Leptospirosis not less than 30 days prior to breeding
- _____ Turn cows with calves out to pasture and feed mineral and salt
- _____ Repair fences to hold bull
- _____ Feed magnesium oxide to prevent grass tetany
- _____ Plan your fly control program and start face fly control measures
- _____ Start breeding yearling heifers one cycle earlier than mature cows (mid to late May)
- _____ Castrate and dehorn calves before they are 45 days old

MARCH

- _____ Observe herd closely, especially heifers for calving difficulty
- _____ Check ration balance; be sure it is adequate for cows with calves
- _____ Identify calves and record birth dates
- _____ Separate pregnant cows from cows with calves
- _____ Watch for scours

BEEF COW MANAGEMENT CALENDAR (Continued)

JUNE

- _____ Turn bulls with cows in mid-June
- _____ Have adequate bull power
- _____ Grain feed young bulls if needed
- _____ If inseminating, check the herd daily. Inseminate 12 hours after heat is detected
- _____ Rotate cattle among pastures
- _____ Plan to cut hay at optimum time for quality hay, especially protein level
- _____ Treat for face, horn, and stable flies as needed
- _____ Continue furnishing adequate shade, water, mineral, and salt

JULY

- _____ Keep out the neighbor's bull
- _____ Check for cows returning to heat
- _____ If desired, calfhood vaccinate heifer calves with Strain 19 for brucellosis before they are 6 months old
- _____ Continue a vigorous fly control program
- _____ Use supplemental summer pasture if needed. Creep feeding calves may be necessary
- _____ Clip pastures

AUGUST

- _____ Double-check fly control program. Check for pinkeye and treat. Check water and feed supply
- _____ Establish permanent pastures if needed. Fertilize existing pastures for fall growth
- _____ Remove bulls
- _____ Plan your winter feed supply
- _____ Consider crop residues

SEPTEMBER

- _____ If grass tetany has been a problem, continue feeding magnesium oxide
- _____ Plan your calf marketing program
- _____ Check for footrot and cancer eye
- _____ Don't graze most sorghum crops between first frost and definite killing frost because of prussic acid in the regrowth shoots

OCTOBER

- _____ Pregnancy check and worm cows
- _____ Treat for external parasites
- _____ Sell barren cows
- _____ Worm calves and treat for grubs
- _____ Start planning next year's breeding program
- _____ Test forage for nutrient content
- _____ Line up winter protein source for best buy to supplement your forage program

NOVEMBER

- _____ Wean calves and weigh and grade
- _____ Work out a vaccination program with you veterinarian. (Vaccination possibilities - Black-leg and Malignant Edema, IBR, PI₃, and Pasturella)
- _____ Make initial selection of replacement heifers for soundness, good conformation, and fast growth
- _____ Separate replacement heifers from cow herd for winter and provide a good level of nutrition and shelter
- _____ Turn cows into stalk fields.
- _____ Plan no more than 60 days/acre/cow (2 cows/acre/month) when grazing

BEEF COW MANAGEMENT CALENDAR
(Continued)

NOVEMBER (Continued)

- _____ Cull low producing cows
- _____ Supply protein minerals, and
- _____ salt to cows on stalk fields

DECEMBER

- _____ Check cows daily for evidence of abortion, heat period, and rubbing or scratching due to external parasites
- _____ Check feed supplies for cows grazing stalks and continue furnishing supplemental protein, minerals and vitamins.
- _____ Have a convenient supply of water, not frozen
- _____ Group like cows together for winter management of cow herd
- _____ Check your cattle business records to pinpoint where you need improvement

The following are two examples of extension circulars which could be extremely beneficial in teaching beef production in Oregon.

Check with your local extension office for a catalog of extension materials which are available. The school should buy this material because the extension service has not been designated to provide instructional materials for school use. However, the cost is very minimal.

UNDERSTANDING CALF SCOURS

Disease prevention is never dramatic and always costs money, but in the long run prevention is more economical than cure.

This circular discusses the available knowledge on calf scours, as an aid to prevention. Preventing scours will be an economic aid to everyone in Oregon's livestock business.

Calf scours is a nonspecific term covering a number of noninfectious and infectious enteric (intestinal) diseases which can produce diarrhea, emaciation, dehydration, weakness, prostration, and death. Specific agents range from intestinal parasites to viruses. Occasionally nutritional imbalances, toxic substances, drugs, or stress also may be involved. Often there may be more than one cause. Such complexity makes it impossible to consider calf scours as a specific disease.

In management to control calf scours you must determine the probable cause (or causes). To do this, carefully examine sick animals and make postmortem examinations of dead animals.

Specimens from sick animals, and fresh carcasses should be examined promptly by a veterinarian for parasitism, poisons, and disease organisms. This can aid treatment, control, and prevention.

A check list whether mental or written, is a useful aid to diagnosis:

1. What is the season of the year?
2. Does the infection follow the pattern of an infectious disease or poisoning?
3. Are the calves free or confined?
4. Is there overcrowding?
5. What are the ages of the affected animals?
6. Does the operation have sound principles of husbandry?
7. Is there adequate protection from weather?
8. Do calves receive colostrum in the first 6 hours of life?
9. How and what are the calves fed?
10. Have the calves been exposed to known pathogens or sick animals?
11. What are the sanitary arrangements, particularly in connection with feeding and housing?

Answers to these questions may suggest what contributing factors are involved. They may also indicate the actions needed to eliminate or control the disease.

SPECIFIC CAUSES

Stress

Most calf scours can be reduced or controlled by management practices that reduce animal stress. Calves held in overcrowded, poorly drained lots or pens, with no shelter and ineffective manure disposal, may experience many scours outbreaks, especially in beef calves. Dairy calves held in close confinement, in crowded calf pens, in poorly ventilated barns with little or no exposure to direct sunlight, also are prone to scours. Improper care or attention during birth, failure to disinfect the naval core, and failure of the calf to receive colostrum within the first 6 hours after birth promote stress and contribute to scours outbreaks. Poor feeding practices also make calves more susceptible to gut infections and scours.

Most beef calves are born in the late winter or early spring, in weather that promotes stress. On many ranches, cattle are brought together for supplemental feeding at this time and the combined effects of overcrowding, inclement weather, and unsanitary environment can result in explosive outbreaks of diarrhea.

Ranchers and dairymen should review and upgrade their management practices constantly to reduce stress on their animals. Improvement of the conditions under which calves are born and spend their early lives often will lower the severity and number of scours cases.

Colostrum Deficiency

Newborn calves have no antibodies to prevent infectious diseases. Colostrum (first milk) provides these vital antibodies during the first few hours of life. They can be absorbed by the calf's intestine for only about 12 hours, hence the first day of life is a most critical period to protect the calf against infectious agents. Colostrum is vital. Fortunately, it can be preserved by freezing and fed weak or orphan calves as required.

Vitamin A Deficiency

Scouring in calves can result from vitamin A deficiency in the cow during pregnancy. This condition usually is seen in conjunction with more severe clinical signs involving other births in the herd, such as abortions, retained placenta, and the birth of blind, deformed, or weak calves. Vitamin A problems can be expected when poor quality hay must be fed to pregnant cattle over a long period. Vitamin A may be administered to the pregnant cow via the feed or by intramuscular injection. The response often is dramatic and the expense is not great. The newborn calf is

devoid of vitamin A and must obtain this vitamin from colostrum or by injection.

Nutritional Influences

The ration cows receive during gestation has a significant influence on viability and disease resistance of newborn calves. Adequate digestible nutrients and protein requirements should be satisfied; cows should be well fed but not fat.

A deficiency of phosphorus in the ration can contribute to scouring in young calves. The ratio of calcium to phosphorus should be on the order of 2:1. Mineral supplements should be fed to provide adequate amounts and proper ratio of these major mineral elements. Mineral supplementation should be adjusted to the major source of available winter roughage. Deficiency of trace mineral elements such as selenium and copper may occur and influence the general herd health and thus susceptibility to disease. In areas where selenium deficiency has been identified as a factor contributing to scours; calves should receive selenium injections, even though cows have been treated prior to calving. Trace elements should be added to the mineral supplement when it has been determined that their deficiency is contributing to poor health and weak calves.

Milk Scours

Excessive milk consumption by young calves may contribute to scours outbreak in some herds. Undigested milk particles overload the intestines and promote the growth of bacteria that contribute to scouring.

A slight reduction in the cow's feed intake for a few days following calving will limit milk production and may assist in the control of scours in newborn calves. Cows should be on full feed by two weeks after calving. This practice will assure adequate milk production for the calf, and provide sufficient nutrients for early rebreeding of the cows.

Umbilical Infections

When birth occurs, the navel cord is broken and remains wet and spongy for several hours. During this time micro-organisms can enter into internal organs of the calf if the cord is not treated with a germicide. Scouring is one of many disease signs that can result from navel infection. Disinfection of the umbilical stump soon after birth is very important. A liberal application of strong tincture of iodine is particularly important where calves are born in a confined area.

Coliform Scours

Coliform scours is perhaps the most common and most difficult diarrhea to handle. The disease is caused by bacterial organisms (Coliform bacilli) that normally live

in the intestinal tract but have become pathogenic (disease causing) because of lack of body defenses. Coliforms multiply with great speed and if their number becomes excessively high, or when they occur outside the gut, they can cause disease. The feces of calves with coliform scours usually are fluid, light colored, and may become blood tinged. Day-old calves can become infected. The hair coat becomes rough, the nose is dry and crusty, and the eyes are sunken. Dehydration and secondary pneumonia are common. Death losses can be high. Coliform scours are hard to control, but the number of infected animals can be reduced by sanitation, and isolation of infected calves. Vaccines are available to help control scours due to *E. coli*. The cows are injected twice during late gestation and calves derive protection via colostrum.

Salmonella or Paratyphoid

Salmonella or paratyphoid organisms are often found in calves with scours. These organisms can cause disease in animals and man, and constitute a potential public health problem. These infections usually involve animals moving through stockyards, salesyards, or other congested areas.

Replacement calves often are brought from salesyards to place on cows that have lost their calves. This practice ordinarily will not cause damage, but once in a while the replacement calf will introduce an infection that can develop into a serious herd problem. To avoid this, the cow and the replacement calf should be isolated from the herd for 10 days and observed for disease signs. If none appear, the animals can be returned to the herd with relative safety.

Enterotoxemia

Enterotoxemia occurs in many parts of Oregon. In young calves this disease usually is caused by *Clostridium perfringens* Type C. Vaccination can be effective when properly administered and should be done in areas where enterotoxemia is present. Although scouring is not an outstanding clinical sign, it may occur late in the course of the disease. When enterotoxemia is involved, a cattleman usually will find one or more of his best, fastest-growing calves dead, without having shown any signs of illness. Post-mortem examinations of these calves usually will reveal severe hemorrhages in the intestines. Prevention of this disease is the only effective method of control.

Virus Infections

Several viruses are known to cause diarrhea in calves. This undoubtedly will become a large and complex field as more is known about viral disease. Virus infection is now known to affect coliform scours incidence and losses and to be a direct cause of certain other forms

of calf scours. Viruses do not respond to antibiotic therapy, but may be controlled by vaccination. Viral vaccines now available protect newborn calves against specific viral diarrhea. Research may provide additional vaccines to protect against other viruses in the future. Usually viral diarrhea in cattle is relatively mild, but damage to the gut lining may allow entry of bacteria which are always present in the gut. Tests should be made by the diagnostic laboratory to determine if viruses are contributing to a scours outbreak.

Coccidiosis

Coccidiosis is an important parasitic disease of calves and is quite widespread. It usually occurs in calves over three weeks of age. The outstanding sign is a profuse blood-streaked diarrhea. Since the lower bowel is mainly affected, the blood in the feces is quite red. The rear legs and tail are usually soiled with blood and manure. The parasite spends most of its life cycle in the intestinal lining cells, and destroys them. Response to treatment depends upon the number of cells affected. If the infection is extremely heavy and most of the lining cells are destroyed, the animal will not make a satisfactory recovery. Diagnosis usually can be made by microscopic examination of feces. Treatment by one or a combination of intestinal drugs is specific and has been quite satisfactory. Calves raised in confinement can receive coccidiostats in their feed and these are effective in preventing coccidiosis.

CONTROL AND TREATMENT

Control

Since scours in young calves is frequently a combined virus and bacterial problem, the greatest losses usually occur during the last half of calving season, and are more severe in heifers' calves. As the calving season progresses, the virulence and number of infectious agents increase, and disease outbreaks become more common. Even well-managed herds can have serious problems.

When scours occur in a beef herd, pregnant cows should be moved from the contaminated area and dispersed as much as feed and water facilities will permit. The dispersion of pregnant cows often will break the infection cycle and limit the outbreak. Under range conditions, any attempt to disinfect the contaminated area probably will be futile. In dairy cattle the management techniques usually determine whether disinfection can or cannot be applied effectively.

Under range conditions, calving on sloping ground usually is more advantageous than calving on level areas. The slope usually provides drainage, and if the area remains reasonably dry, calves are not as apt to become de-vitalized or contaminated by exposure to infective material. A supply of clean water also is needed in the calving lots.

Scours often can be avoided by calving away from corrals, but to give appropriate assistance at calving time, the cattle must be watched as closely as possible. Likewise, if navels of newborn calves are to be treated, the cattle must be accessible. Usually there are areas where cows can be given adequate space during the calving season, and yet held under the control necessary for treating calves and giving other required assistance.

Small portable sheds with openings that will admit calves but not cows, and bedded with straw, provide excellent shelters. Size usually runs about 12 feet long and 8 feet wide. The roof should be high enough to allow the sun to shine on the covered area. Providing the calves with clean, dry quarters will go a long way toward preventing illness.

Treatment

The "shotgun" approach to treatment of calf scours is often effective if it is applied when the disease first appears. First take fecal specimens for laboratory examination and then treat the sick animals with broad spectrum oral antibiotics, anti-diarrheals, and electrolyte solutions. It is a good policy to treat animals that are seemingly well if they are in close contact with the sick.

Loss of body fluid is the most frequent cause of death from scours. Water excretion is increased as much as 30 times normal. This loss leads to dehydration. In addition to water loss, electrolytes (the salts necessary for normal body function) are lost in large amounts when calves scour.

Treatment of severe scours in calves should be directed toward replacing the water and electrolyte loss, as well as destroying the causative agents. The most effective method of overcoming dehydration is by intravenous treatment. Up to two gallons of water and electrolytes may be administered to a calf intravenously over a 24 hour period. Many veterinarians throughout the west are saving calves with this treatment.

Simple home treatment given by mouth or stomach tube can assist in overcoming dehydration. Scouring calves may be given the following solution at least twice daily instead of milk:

- 1 can beef consomme soup (11 oz.)
- 1 pkg. jam & jelly pectim (2 oz.)
- 2 teaspoons table salt
- 2 teaspoons baking soda
- Add water to make 2 quarts

Calves should be fed this solution together with a suitable antibiotic. After two or three days treatment, or as soon as scouring ceases, the antibiotic is discontinued and milk is slowly introduced. With clinical

recovery the calf can be returned to a normal milk diet. The calf's mother should be completely milked out prior to the return of her calf. At no time during treatment should the total fluid intake be below 8 pints daily.

There are several reasons why this system works:

1. The principal cause of death usually is dehydration and shock. Fluid and electrolyte therapy keep calves alive long enough for antibiotics to overcome the infection. One pint of fluid for every 10 pounds of body weight is about normal daily fluid intake. Fluids may be given orally, subcutaneously (under the skin) or intravenous. It has been determined that fluids given in the abdomen can cause adhesions; therefore, this route is not recommended. Do not use home-made oral fluids other than by mouth; they are not sterile.
2. Do not feed milk during the first 24 hours of treatment. Ordinary milk is a good bacterial feed and continued intake of cows' milk could favor bacterial growth and prolong the scours.
3. Antibiotics or other drug therapy is compatible with fluids and can be directed at the causative agents.

Avoid prolonged use of antibiotics, since they interfere with normal digestive processes. If calves are medicated orally with antibiotics beyond a 48-hour period, it is advisable to feed *Lactobacillus acidophilus* culture after antibiotic medication is stopped.

Give young calves access to clean drinking water and a salt-mineral box. These can be located in a calf creep or shelter area. If they are readily available, sick calves may spontaneously replace some of their lost water and electrolytes.

Without doubt, there are many cases of calf scours where the cause is unknown. It is always worthwhile to examine each outbreak. Autopsy of dead or dying calves is recommended in order to identify factors responsible for the disease. With proper identification, many forms of scours can be effectively and quickly controlled. The saving in time, medication and calves makes prompt action and thorough investigation of each outbreak economically worthwhile.

WHITE MUSCLE AND OTHER SELENIUM-RESPONSIVE DISEASES
OF LIVESTOCK

PNW 157

A significant research finding reported from Oregon State University in 1958, was that the underlying cause of white muscle disease was a dietary deficiency of the trace element selenium (Se). There is a fairly clear-cut relationship between soil, plant and animal factors involved. Certain soils, especially some formed within the past 10,000 years or so as a result of volcanic action, contain practically no selenium. As a result, plants grown on them are seriously selenium-deficient, and the deficiency is passed on to animals consuming the plants as fresh forage, hay or silage.

In addition to the amount of selenium available in original parent material in soil formation, the supply is affected by intensive cropping practices. Irrigation tends to leach Se out of the topsoil and the application of some commercial fertilizers, because they result in higher crop yields, reduces the percentage of selenium in the forage.

Effects of Selenium Deficiency

The first important evidence of Se deficiency in the Northwest has been aptly named "white muscle disease". It involves muscle damage, in the course of which calcium salts may be deposited among the muscle fibers in certain parts of the bodies of affected animals. These salts give the areas involved a whitish appearance. Both skeletal muscles, such as those of the legs and back, and heart muscle, may be affected. When skeletal muscles are affected, the animals may have difficulty walking and be unable to rise. When the heart is affected, the animal may die from sudden heart failure. Some animals show signs of respiratory distress and may be treated by the owner for pneumonia. They do not respond to antibiotic therapy and death may occur as a result of fluid accumulation in the lungs.



White muscle disease is most common in newborn lambs or calves, which will show clinical signs from birth to an age of 4 to 6 weeks. It occurs occasionally in yearlings or older animals.

Cows or ewes receiving a selenium-deficient diet during gestation may give birth to offspring suffering from this trace-mineral deficiency. Their calves or lambs may be born dead or weak and die during the first few days of life. In cases of extreme deficiency, permanent damage may occur, in which case the newborn animals will not respond to selenium injections. In these instances it is necessary to provide the dams with adequate selenium during gestation. This is accomplished by injecting the pregnant cows or ewes with carefully calculated amounts of Se salts in solution, or providing an adequate Se source in the diet.

The influence of Se supplementation on the livability of newborn calves has been observed in a number of beef herds. Some calves in selenium-deficient herds have impaired structure and function of the thyroid gland. This is an additional stress for the newborn which can mean the difference between their ability to live or die.

A deficiency of this trace element also contributes to unthriftiness of yearling and adult animals. This is often referred to as "ill thrift." Many of these animals will develop a profuse diarrhea, be unable to utilize feed properly, and may die. Their hair coat may develop a blanched or "washed-out" appearance. Many animals so affected have a rough hair coat and do not shed normally in the spring to develop the normal, healthy, sleek appearance.

An increased incidence of retained fetal membranes has been documented in dairy cows on selenium-deficient diets, and this also has been suspected in beef herds. The problem has been alleviated by adequate Se supplementation. The retention of fetal membranes beyond 24 hours contributes to infection of the uterus and impairs subsequent breeding ability.

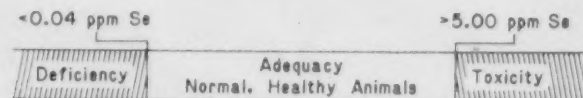
Defining the Selenium Status of Animals

The occurrence of white muscle disease in one or more young animals is definite evidence of Se deficiency. But this is a costly method of detection in that it may entail the loss of one or more young and other production losses such as impaired growth of the young or lowered reproduction efficiency.

The content of Se in blood is a reliable indicator of the Se status of animals. Blood samples should be collected in heparinized vacutainer tubes by your veterinarian and submitted to a reliable analytical laboratory for Se determination. We consider 0.01 ppm Se to be the minimum acceptable blood level for beef cows. Breeding ewes and dairy cows have a higher requirement for this

mineral, and their respective blood levels should be 0.05 and 0.07 ppm.

In a survey of beef cows in Oregon during 1975-76, two-thirds of the blood samples tested were Se deficient, as judged by these values. A minimum of 5 samples was collected from each herd, and the herds represented all major geographic areas in the state. This study also showed that cows grazing native range had nearly twice the blood Se level of cows grazing improved, irrigated, fertilized pastures (0.049 vs. 0.026 ppm Se respectively).



Relationship of selenium (Se) levels in forage or feed (parts per million) and animal health

Selenium is now known to cause metabolic effects in animals as an integral part of the blood enzyme glutathione peroxidase (GSH-PX), so the level of this enzyme in the blood may be used to indicate an animal's Se status. When Se deficiency exists, this enzyme level is below 20 units of activity per milligram of hemoglobin. The advantage of determining the Se status of animals by GSH-PX activity is that it is faster and less expensive than determining Se itself and is a more accurate assessment of Se availability since it deals with the active form of Se.

Correcting Selenium Deficiency

There are several ways to provide Se once the need for it has been determined. It may be given directly to the animals by injection, and preparations containing both Se and Vitamin E are commercially available.

The U.S. Food and Drug Administration has recognized that Se is essential to food animals and has cleared its use as a supplement, when necessary, in livestock feed and salt. Commercial feed manufacturers may now add Se to reflect 0.1 ppm of the total diet. It can be added to salt at a level of 20 ppm for cattle and 30 ppm for sheep. Offering such supplemented salt free-choice to cattle and sheep may provide the necessary Se for the complete diet.

Livestock growers should take advantage of these methods of supplementing Se to help prevent deficiency problems. Under some condition, such as low Se in forage and other factors that interfere with Se metabolism, the levels cleared by the Food and Drug Administration may be inadequate to overcome Se deficiency. The Se status of animals should be determined after supplemental Se has been fed for several months. If a deficiency still persists, as determined by whole blood Se or GSH-PX tests, additional Se can be provided legally on prescription by

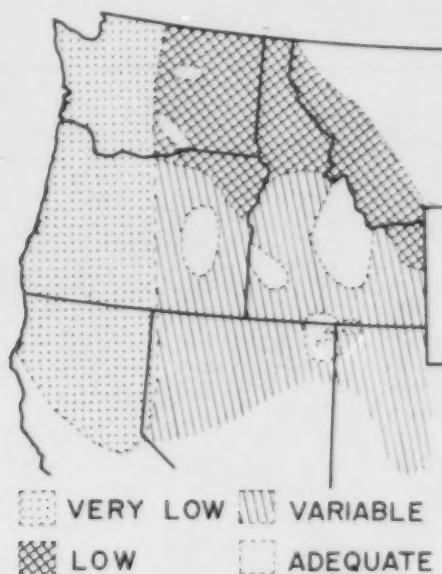
a veterinarian.

Modern forage production practices tend to reduce the Se level in livestock feed. To combat this, research workers in New Zealand, Australia, and the United States include Se in commercial fertilizers. This is an alternative method of Se supplementation that may provide an easier answer to a complex problem at some future date. Plants in general do not require selenium for normal growth, but its involvement in animal health has been dramatic and significant.

Selenium, like some other nutrient materials, can be dangerous to animals if given in excess. The problem is especially critical with Se because the animal's requirement for it is extremely low (in the area of 0.1 ppm of the diet dry matter; that is, 1/10 part of Se per million parts of dry feed). Excessive amount of selenium are known to cause toxicity problems in animals.

Selenium should be used only where a need for it can be demonstrated, and it should be used with caution. The range of selenium in animal diets and the consequent effects on animal health are shown in the accompanying graph. Local variations may alter the absolute figures.

The map outlines areas with respect to the selenium content of forages generally available to livestock. Soil scientists of the USDA developed this map in 1968, based on analysis of forage samples collected in the Pacific Northwest. The selenium-deficient areas conform closely to the incidence of white muscle disease in animals as reported by veterinarians.



General level of selenium in Pacific Northwest forages

Selecting Beef Cattle

I. Determining the Type of Producer

Prior to selecting beef animals, one must determine the method or type of operation he/she will use to produce beef. There are three principal types of producers: breeder cattle producer, commercial cow-calf producer, and slaughter cattle producer. Several factors will determine the method or methods a producer selects.

Factors to consider and a brief explanation of each type of production follow:

- A. The breeder producer produces breeding stock for other breeders and the commercial cow-calf producer. Before deciding to become a breeder cattle producer, a rancher should consider the following factors:

Transparency No. 1

1. Breeder cattle production requires much more capital than commercial cow-calf production.
 2. Breeder cattle production requires more equipment and labor than other types of beef production.
 3. Years of breeding are required to establish a reputation for breeding quality cattle; the breeder producer must have patience.
 4. The breeder producer must be able to anticipate the demand for cattle, both as to type and number.
 5. The breeder producer must be a proficient breeder or hire a proficient breeder.
 6. Very few breeders become master breeders.
- B. The objectives of a commercial cow-calf producer are to have each cow to produce a calf annually, at a weight and age that is desirable to the market, and to receive the greatest return on his/her labor and investment. He/she may sell his/her calves at weaning as slaughter calves or as feeder calves to a slaughter cattle producer.

The commercial cow-calf producer may enjoy some special advantages in the production of feeder calves, but one must consider both the favorable and unfavorable factors relative to entering this type beef enterprise.

Transparency No. 2

Factors Favorable to Commercial Cow-Calf Production are:

1. Commercial or grade cattle require a smaller investment per animal unit than purebred cattle, and they generally require less investment in buildings and equipment.
2. Commercial cattle generally require less labor for their care than purebred cattle.
3. The cows can be maintained on lower-grade roughages and pasture with less need for supplemental feeding of grain and other more costly commercial feeds.
4. A commercial cow-calf program can be adapted to land areas not suitable for the production of crops or high yielding forages.
5. Less short-term risk is involved than in a slaughter cattle feedlot operation.

Factors that may be Unfavorable to Commercial Cow-Calf Production are:

1. The price fluctuation in market cattle is usually greater than for breeder cattle.
2. High-quality purebred bulls are usually excessively high and difficult to obtain.
3. Replacement cattle particularly in a cross-breeding program will require the breeder to maintain more than one herd of breeding cattle.
- C. The slaughter cattle producer tries to produce slaughter cattle at a desirable finish in the shortest possible time. Dry lot fattening, pasture fattening, and a combination of the two are methods used by the slaughter cattle producer to finish cattle.

The following factors should be considered by the prospective slaughter cattle producer:

Transparency No. 3

1. A large amount of capital is required to buy feeders. Slaughter cattle production is a volume business.
2. There must be an adequate feeder cattle supply available.
3. Adequate facilities for handling cattle must be provided.
4. Large quantities of feed must be available at a price that the producer can pay and still make a profit.

5. The slaughter cattle producer must be an efficient feeder.
6. There must be a demand for the grade of slaughter cattle produce.
7. The slaughter cattle producer's margin of profit is small.

In addition to considering the above factors, the slaughter cattle producer using pastures to fatten cattle must provide adequate grazing.

II. Selecting a Breed of Cattle

A rancher should consider the following factors when selecting a breed of cattle:

Transparency No. 4

1. Personal preference likely will determine the breed with which the breeder may experience greatest success.
2. The availability of the breed in the community and area will determine the breeder's source of supply.
3. Environmental conditions including climate, grazing, disease, and insect and parasite problems.
4. Demands for the breed from other purebred and commercial breeders
5. Cost of establishing the herd

There are two kinds of breeder cattle producers, the purebred breeder and the crossbred breeder.

III. The Selection of Individual Animals

Selection, based on several factors, is the only method a rancher has of improving beef cattle. Regardless of the method used to produce beef, the producer must constantly buy, sell, and cull animals in his herd. It is estimated that an average of 20 percent of a breeding herd is replaced each year, with the older and non-producing animals being replaced with younger animals. If the breeder or commercial cow-calf producer culls at this rate, he will have a new herd every five year.

Components that should be considered are conformation, age, production, and pedigree.

A. Conformation as a Basis for Selecting Beef Animals.

The ultimate objective in producing beef is that of selling meat to the consumer. Thus, fads or fancies that stray too far from this objective will eventually bring a penalty.

Transparency No. 5

After the person has learned the parts of a beef animal, he/she must then become familiar with the wholesale cuts of meat and the areas of the carcass where they are located. The beef animal having desirable conformation should yield a large percentage of rib, loin, and round. Animals with desirable type or conformation will possess desirable muscling and finish. The forequarters, brisket, plate, belly, and flank yield the low priced cuts and constitute the areas of greatest waste and should make up as small a percentage of the carcass as possible.

Transparency No. 6

After the individual has become familiar with the parts of the beef animal and the wholesale cuts of meat and their location on the carcass, he/she should develop a mental picture of the ideal or model live animal which will produce the most and highest quality meat.

From the standpoint of the producer, under practical farm and ranch conditions, functional efficiency is extremely important. This is to say, for example, that a large barrel capacity is directly related to efficiency of feed conversion and milking ability, or that a smaller cow requires a lesser maintenance cost than a large cow. Thus the most profitable animals will be those that strike a happy medium between conformation or type, as related to the maximum production of a high-quality product, and the efficiency of production of this product.

In selecting beef cattle, keep in mind that the show type should be the most useful commercial type. The standards in the show ring are the results of the tireless efforts of breeders who comply with the exacting demands of the consumer of beef and with the rigid requirements of cattle producers. Therefore, the selection should be made with greatest emphasis on the utility values in beef production.

When selecting beef animals, one should follow a definite order of inspecting animals, and this order should be used each time a person selects animals. The following order of inspection has been recommended for selecting beef cattle: Step I, sideview; Step II, rear view; Step III, front view; and Step IV, contact step. The animal is observed from approximately 20 feet in the first three steps; and close inspection of the animal is made in step four.

Transparency No. 8

From the sideview-

Steer number 1 is a light framed steer that is very

upstanding and shallow bodied; is light in the rear quarters; is lacking in balance and quality; and shows a lack of muscling and is under finished.

Steer number 2 approaches the ideal in that he exhibits balance and style; has good length of body with a long, full loin and rump and a deep bulging hindquarter; shows extreme muscle development through the arm and forearm region; is trim in the flanks, middle, and brisket; is correct in finish; and stands on ample legs that are correctly placed under the body.

Steer number 3 is a short-bodied steer that is short of leg; is a deep-bodied wasty steer; is an unbalanced, heavy-fronted steer that has a wasty brisket, rear flank, and cod; is over finished; and exhibits only average muscling.

Transparency No. 9

Comparing the carcasses of these three steers from the sideview-

Steer number 1 shows a lack of muscling and finish; is a light-framed steer; and lacks the style and quality of a high grading market steer.

Steer number 2 exhibits desirable length of body with a long, level loin and rump; shows evidence of heavy muscling through the shoulder, loin, and rear quarter with a deep bulging round; carries the correct amount of finish; and would cut out a high percent of the primal cuts (loin, rib, and round).

Steer number 3 demonstrates an unbalanced, heavy-fronted carcass that is too short of body and is wasty in the brisket, middle, and flanks; lacks desirable muscling; is light in the hindquarter; is over finished; and therefore, would cut out a low percentage of primal cuts.

Step 1-side view: Viewing the animal from the side, the neck should be moderately short and trim; the back along the topline should be long and level from the top of the shoulder extending through the rump; the round should be deep, wide, and bulging through the stifle; the rear flank and underline should be trim; the forequarter should be well-muscled with a large forearm; the brisket should be clean and trim; and the animal should stand on ample legs that are correctly placed under its body.

Step II-rear view: Viewing the animal from the rear, good balanced width is desirable with fullness in the fore ribs, across the loin and back, and over the rump; the back and loin should be well-muscled throughout with maximum width in the thighs about midway between the tail

and the hock with extreme bulge through the stifle; also, the animal should stand squarely on his rear legs and should walk with ease.

Step III-front view: Viewing the animal from the front, the legs are correctly set and well-muscled in the arm and forearm; the shoulders taper slightly toward the top, but exhibit balance, fullness, and good muscling; the brisket is clean and trim.

Step IV-contact step: Close inspection of the animal is observed in this step. The degree of finish may be determined by examining the animal as a whole, but it is often checked by pressing the hand on several parts of the body for closer examination.

Patches of fat, which often occur over the ribs, rump, and back are very objectionable. Proper finish is indicated by a firm uniform covering over the entire body. When the finish is lacking, it feels hard and flat.

One should remember that conformation is only one factor to consider in selecting livestock. Since conformation and other characteristics are inherited, several factors should be used as a basis of selection. Visual appraisal is important, but it is only an estimate. An animal may inherit conformation but not gaining ability. Muscling and the proportion of lean to fat are two inherited characteristics that cannot be determined by visual appraisal.

Transparency No. 10

From the frontview-

Steer number 1 shows a lightness of bone and frame; is narrow in the shoulders and legs; and is lacking in muscling and desirable fleshing.

Steer number 2 exhibits wide, well-muscled shoulders and a clean, trim brisket; shows balance and evidence of correct fleshing; and legs are correctly set.

Steer number 3 carrying excessive fat (which is visible in the brisket and over the back and shoulders) is extremely wasty; and is lowest and short legged, lacking the size, scale, and muscling of the number 2 steer.

Transparency No. 11

From the brisket cross section view-

Steer number 1 is narrow and shows little marbling which indicates low yield and probable low tenderness.

Steer number 2 shows desirable muscling and marbling;

Transparency No. 11 (Continued)

in the brisket.

Steer number 3 demonstrates little muscling and is extremely fat and wasty.

Transparency No. 12

From the rear view-

Steer number 1 is light of bone and frame; shows little evidence of muscling in the stifle and round; and does not carry adequate finish for a high grading steer.

Steer number 2 possess highly desirable muscling indicated in the thickness of stifle and round blending into a rounded top at the tail head; stands correctly on legs of ample bone and size; and is uniform and correct in finish.

Steer number 3 is blocky, flat backed, and slab sided indicating an over-fat wasty individual; is extremely low-set; and lacks desirable muscling.

Transparency No. 13

From the round cross section view-

Steer number 1 shows a lack of marbling usually indicating undesirable, tough beef. His narrowness of frame also indicates low yield.

Steer number 2 exhibits a highly desirable degree of muscling, marbling, and size indicating high yield. He also carries a desirable finish.

Steer number 3 is extremely wasty and slight of muscling and show the fat deposit found in flat, wide-backed beef animals which is undesirable.

There are numerous conformation defects which may be found in beef animals. Some are present at birth while others appear with age. It is necessary to recognize the correct conformation and to select animals which transmit it as well as having ancestors which are correctly conformed. Straight, large boned, up-standing individuals are capable of moving about and traveling distances to graze whereas bad legged animals may not be able to do so; thus they are uneconomical.

Transparency No. 14

From the front, beef animals should have adequate width and capacity through the chest with the front legs spaced wide apart and properly set.

Steer number 1 illustrates the front legs and feet turned in, which is known as "pigeon-toed."

Steer number 2 shows correct legs.

Steer number 3 shows the feet and legs turned out

with the knees knocked, which is known as "splayed."

Transparency No. 15

From the rear beef animals should show maximum width through the lower round and stifle and the hind legs should come down straight out of the body with the proper set.

Steer number 1 shows the back legs turned out, indicating weakness of legs.

Steer number 2 shows correct legs.

Steer number 3 shows the hocks turned in, which is known as "cow-hocked," and the feet set up under the body known as "sickle hocked."

Transparency No. 16

The best place to observe bone substance on a beef animal is the "cannon bone area" of the front leg (Figure 1). The cannon bone extends from the knee down to the pastern joint. It is generally thought that cattle with large-sized cannon bones are big framed and heavy muscled. However, there is as much variation of individual animals within a breed as there is between breeds for bone size characteristics.

Cattle with improper "set" to their legs will have more problems, especially under conditions of stress, such as breeding or under heavy weight conditions. For a proper set to the feet and legs, a plumb line straight down from the pin bone at the point of the animal's buttocks should intersect the hock and dew-claw of the rear leg (Figure 2).

If the animal is too heavy for his bone size, a "sickle hocked" condition in his hind legs may result (Figure 3). The weight forces the feet under the body, putting more strain on the muscles and bones of the stifle joint and the hip and leg region.

"Post-legged" or the condition of too little curvature in the hind legs (Figure 4) seems to be a heritable trait, especially prevalent in fine boned cattle. The "post-legged" condition is undesirable because animals put more pressure on the stifle joint with less chance for absorption of the strain over a larger area. This condition sometimes results in torn ligaments and tendons.

Correct legs, length of body, size, depth of body, and muscling are apparent at an early age. These characteristics are highly heritable. Correct udder attachment, and development, number, and spacing of teats in cows, and testes and sheath development in bulls are less apparent until sexual maturity. These characteristics are of extreme importance in the cow-calf operation. (When breeding stock are sel-

ected at a young age, it is very necessary to study ancestors.)

B. Age as a Basis for Selecting Beef Cattle

Generally, age will determine the number of calves a breeding animal can produce and the class of a slaughter animal.

Transparency No. 17

The longer a cow can be kept in the herd, without sacrificing production, the more the animal can contribute to the breeding of the herd, and fewer replacements will be required. The selection of mature cows, four to eight years of age, is considered to be the best buy. Based on sex, cattle are classified as steers, heifers, heiferettes, cows, bulls, and stags; and slaughter cattle are graded as prime, choice, good, standard, commercial, utility, cutter, and canner. Cattle are also classified according to age: calves, yearlings, two-year-olds, cows, bulls, and stags.

C. The Pedigree as a Basis of Selection

The pedigree is an important factor in selecting animals, that is, if the selection is based on the ancestors that are "close-up" in the pedigree. Using the performance of the ancestors should be the principal factor to consider in basing the selection on pedigree. There is a tendency for a bloodline to become a fad. The breeder using the bloodline as a basis for selection should not fall into the "fad trap."

Stockmen are aware that animals differ in economically important traits such as birth weight, weaning weight, daily rate of gain, body type, etc., which are affected by both heredity and enviornment. If improvement in an economically important trait is due to an improved environment, the heritability of that character will be low and little progress can be made through selection. However, if the trait is highly heritable, marked progress can be made through selection. There is a need, threrfore, to know the approximate amount of percentage of change due to heredity.

The following chart from the U.S.D.A. gives the percent of heritability characteristics, which are important factors in selecting animals.

Transparency No. 18

HERITABILITY ESTIMATES FOR BEEF CATTLE CHARACTERS

<u>Character</u>	<u>*Approximate Heritability of Character in Percent</u>
Birth weight	45%
Weaning weight	26%
Weaning conformation score	32%
Daily rate of gain from weaning to marketing	46%
Efficiency of feed utilization	39%
On-foot grade at slaughter time	38%
Carcass grade	39%
Area of rib eye	70%
Reproductive performance	25-30%
Cow maternal ability (Mothering ability and milk production)	30%
Tenderness	50%+
Fat thickness	32%
Carcass yield	35%
Yield of retail cuts	35%

* Levels of heritability and genetic correlations may be interpreted as follows:

Very High	.60 and over
High	.50 to .60
Medium to High	.40 to .50
Medium	.30 to .40
Low to Medium	.20 to .30
Low	.10 to .20
Very Low	.00 to .19

There are many bloodlines or families within a breed, and animals of certain bloodlines have certain characteristics which can be recognized by some breeders. The inexperienced breeder should determine the bloodline(s) he/she is going to purchase and breed within the selected bloodline; however, experienced breeders have been successful crossing bloodlines.

The bloodline of the bull is more important than that of the cows, for his bloodline will be distributed to all the offspring. It is generally believed that cows having the same bloodline will produce a higher percentage of good calves; however, some breeders believe a good herd sire will nick with most any bloodline.

For those interested in producing purebred cattle, the registration paper is only as good as the breeder's reputation. Breeding stock should be purchased from reputable breeders. Also, the registration paper only gives the animal's ancestry and not any assurance of economical beef production.

D. Production Testing as a Basis of Selection

Production testing is the most infallible basis of selection, particularly for selecting young herd sires. Production testing embraces both (1) Individual Merit Testing and (2) Progeny Testing.

Individual Merit Testing (or Performance Testing) is the practice of evaluating and selecting on the basis of the animal's individual merit.

Progeny Testing is the practice of selecting animals on the merit of their progeny (offspring).

To keep accurate records, the breeder must make positive identification of each animal and its offspring. This may be done by fire branding, by using neck chains or ear tags, or by tattooing the animal's ear.

In order to be most effective, selection by production testing must be based on characteristics of economic importance and high heritability, and an objective measure such as pounds, inches, etc. should be placed on each of the traits measured. Those animals that fail to meet the standards set forth should then be removed from the herd.

Many of the beef cattle breed associations have initiated programs for recording production records on individual animals, and also on herds within the breed. Several breed associations and also private processing centers offer data processing equipment for cattle breeders who are interested in keeping complete records on their herds.

Transparency No. 19

Example production form of recording "Calf and Yearling Weights and Grades"

Transparency No. 20

Example production form for recording "Sire's Annual Production Record of Dam"

Example production form for recording "Lifetime Production Record of Dam" (cows)

The above forms are examples of records being used by ranches who are production testing their herds.

References:

1. "Livestock Judging and Evaluation," Bulletin AS-388, Animal Sciences Department, Cooperative Extension Service, Purdue University, Lafayette, IN.
2. "Judging Slaughter Steers," B-1026, Texas Agricultural Extension Service, Texas A&M University, College Station, TX.

FACTORS TO BE CONSIDERED BY PROSPECTIVE BREEDER CATTLE PRODUCERS

1. CAPITAL REQUIRED
2. EQUIPMENT AND LABOR REQUIRED
3. TIME REQUIRED
4. FUTURE DEMANDS
5. BREEDING PROFICIENCY
6. NUMBER OF MASTER BREEDERS

FACTORS FAVORABLE TO COMMERCIAL COW-CALF PRODUCTION

- 1. SMALLER INVESTMENT PER ANIMAL UNIT**
- 2. LESS LABOR REQUIRED**
- 3. LOWER LEVEL OF NUTRITION REQUIRED**
- 4. ADAPTABLE TO LESS PRODUCTIVE LAND AREAS**
- 5. LESS SHORT TERM RISK INVOLVED**

FACTORS UNFAVORABLE TO COMMERCIAL COW-CALF PRODUCTION

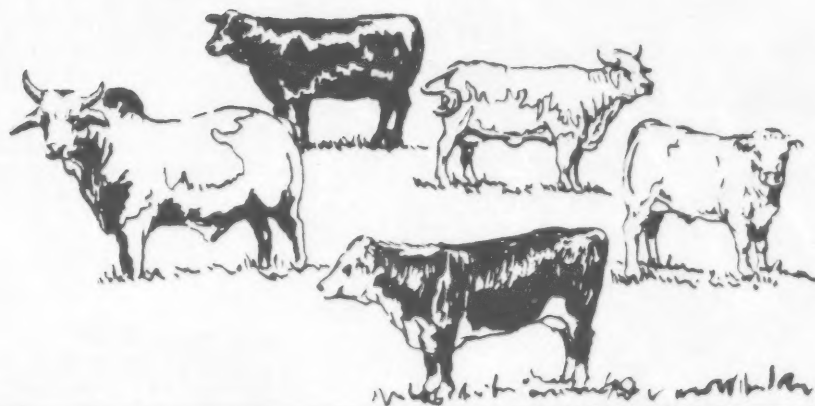
- 1. SUBJECT TO GREATER PRICE FLUCTUATION**
- 2. HERDBULLS USUALLY EXPENSIVE**
- 3. BREEDING PROGRAM MAY REQUIRE MULTIPLE HERDS**

FACTORS TO BE CONSIDERED BY PROSPECTIVE SLAUGHTER CATTLE PRODUCERS

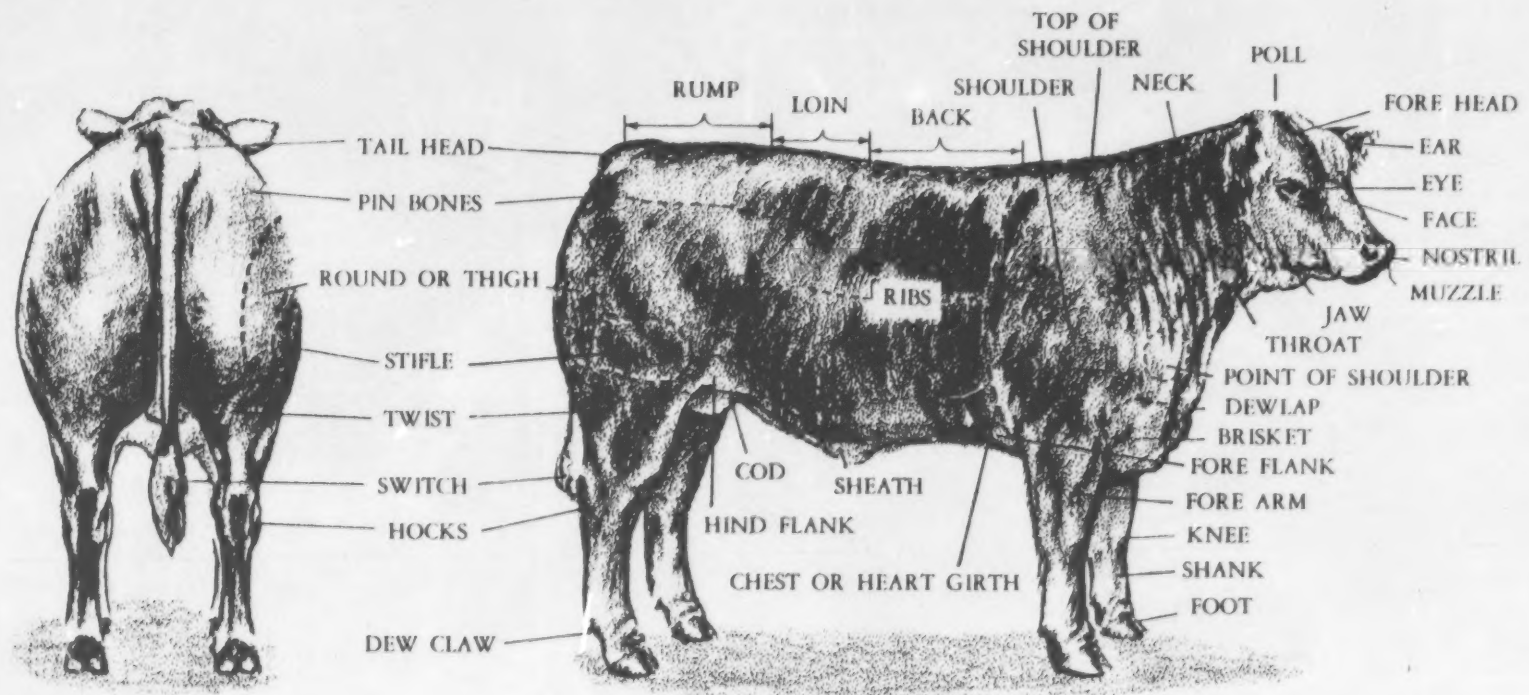
1. CAPITAL REQUIRED
2. FEEDER CATTLE SUPPLY
3. HANDLING FACILITIES
4. AVAILABLE FEED SUPPLY
5. FEED EFFICIENCY
6. SLAUGHTER CATTLE DEMAND
7. PROFIT MARGIN

FACTORS TO CONSIDER WHEN SELECTING A BREED OF CATTLE

1. PERSONAL PREFERENCE
2. AVAILABILITY OF BREED
3. ENVIRONMENTAL CONDITIONS
4. DEMANDS FOR THE BREED
5. COST OF ESTABLISHING THE HERD



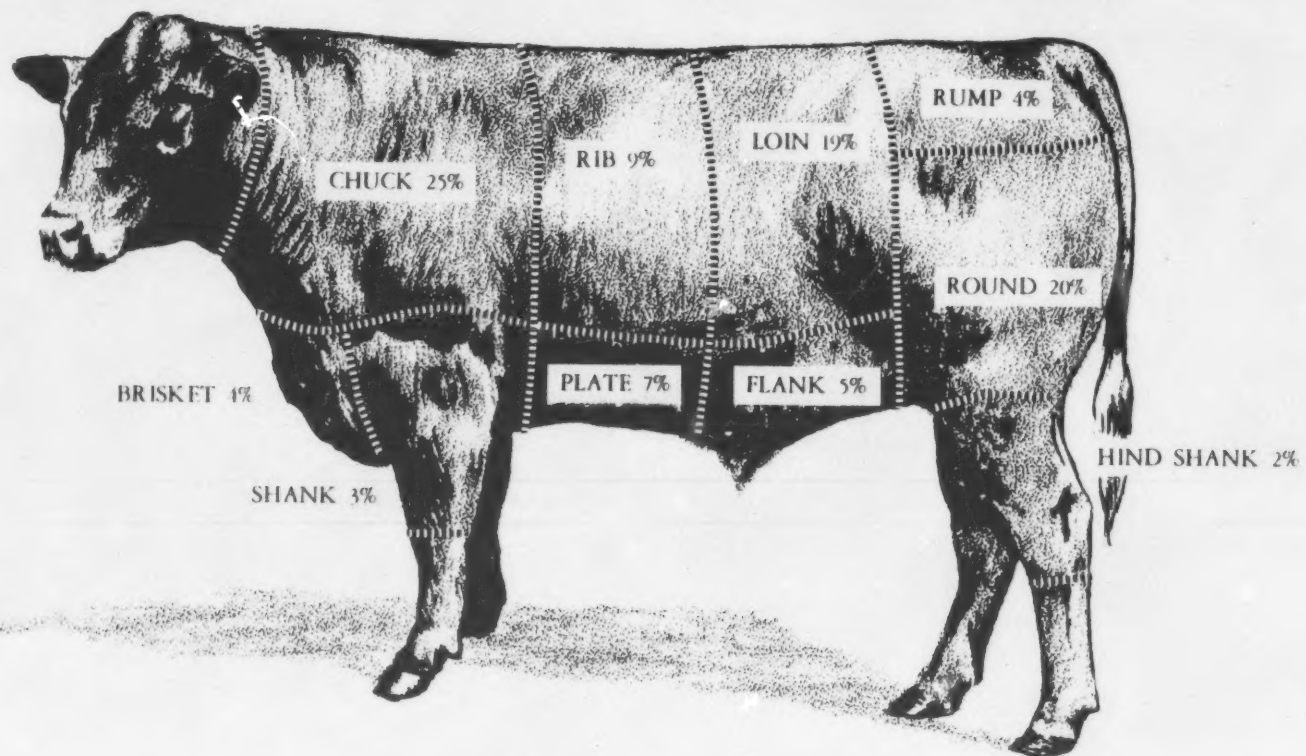
PARTS OF A BEEF ANIMAL



TN-5

AGI-VI-93

WHOLESALE CUTS OF BEEF



TM-6

AGI-VI-94

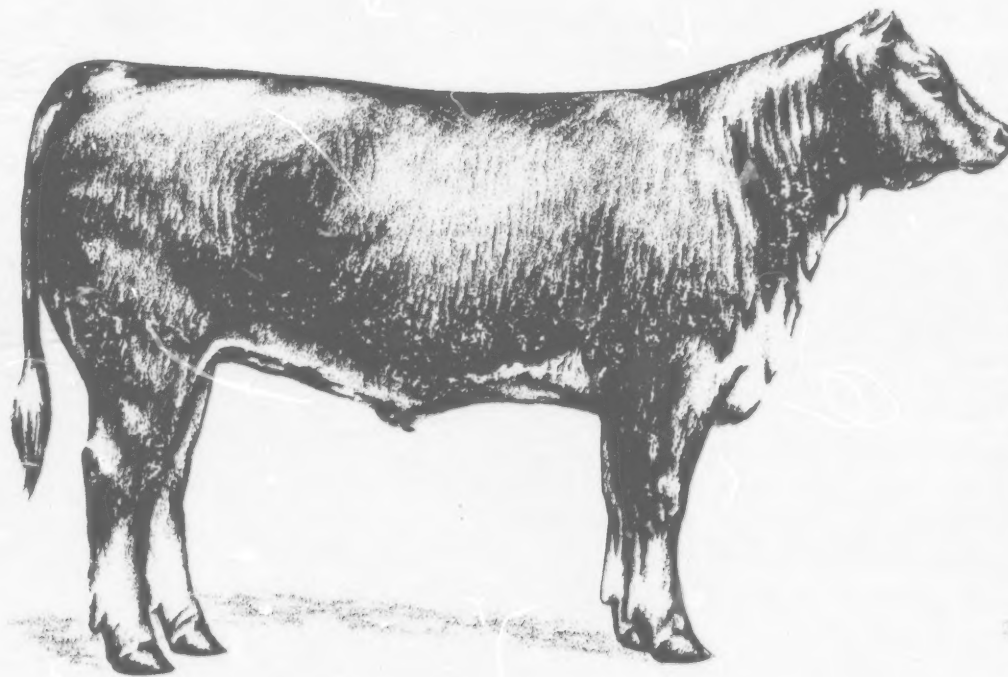
271

272

IDEAL BEEF CONFORMATION



REAR VIEW



SIDE VIEW



FRONT VIEW

ARI-VI-95

TM-7

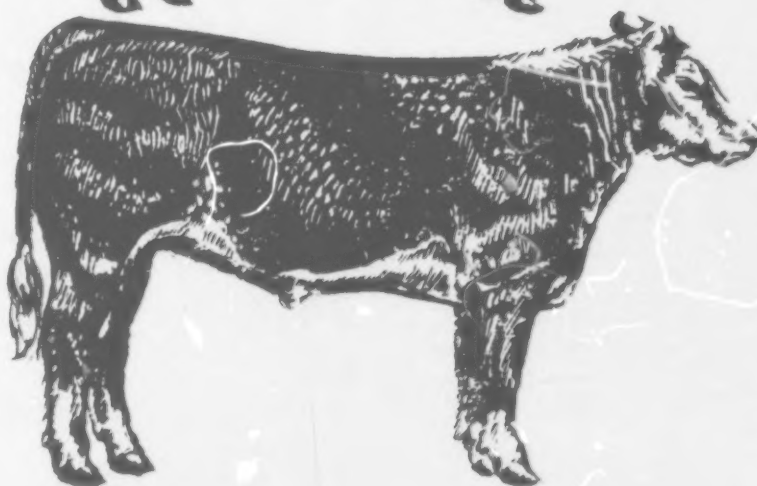
273

274

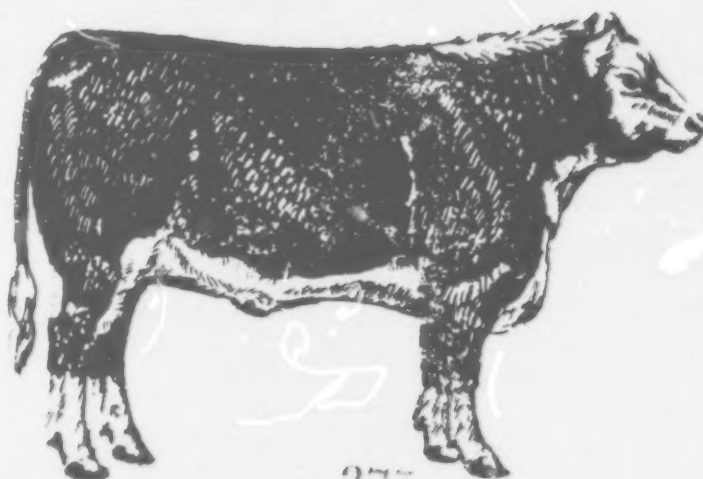
COMPARISON OF LIVE STEERS (SIDE VIEW)



STEER 1



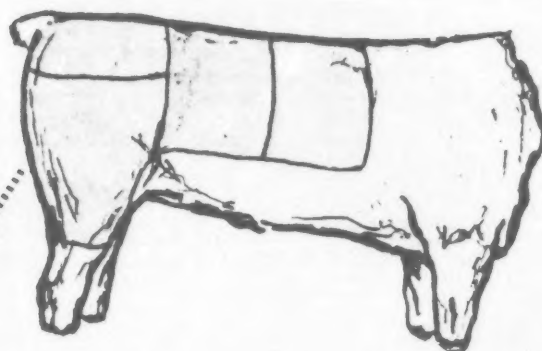
STEER 2



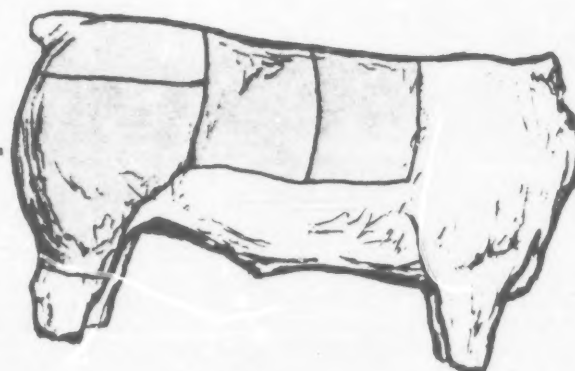
STEER 3

275

COMPARISON OF STEER CARCASSES (SIDE VIEW)

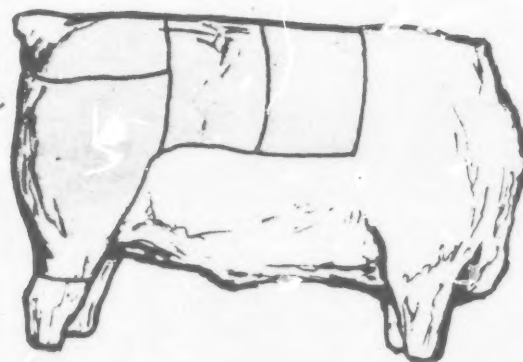


STEER 1



STEER 2

*area of
primal cuts*



STEER 3

COMPARISON OF LIVE STEERS (FRONT VIEW)



STEER 1



STEER 2



STEER 3

TM-10

A21-VI-98

277

278

CROSS SECTION OF STEER CARCASSES (FRONT VIEW)



STEER 1



STEER 2



STEER 3

COMPARISON OF LIVE STEERS (REAR VIEW)



STEER 1



STEER 2



STEER 3

TM-12

AGI-VI-100

292

291

CROSS SECTION OF STEER CARCASSES (REAR VIEW)



STEER 1



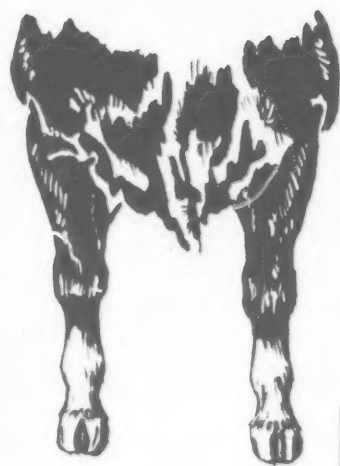
STEER 2



STEER 3

TM-13

COMPARISON OF CORRECT WITH DEFECTIVE FRONT LEGS



CORRECT



SPLAY FOOTED



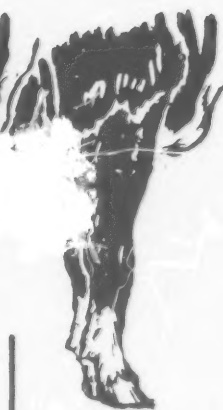
TOED IN



CORRECT



CALF KNEED



BUCK KNEED

COMPARISON OF CORRECT WITH DEFECTIVE HIND LEGS



CORRECT



OUT IN
THE HOCKS



COW HOCKED



CORRECT

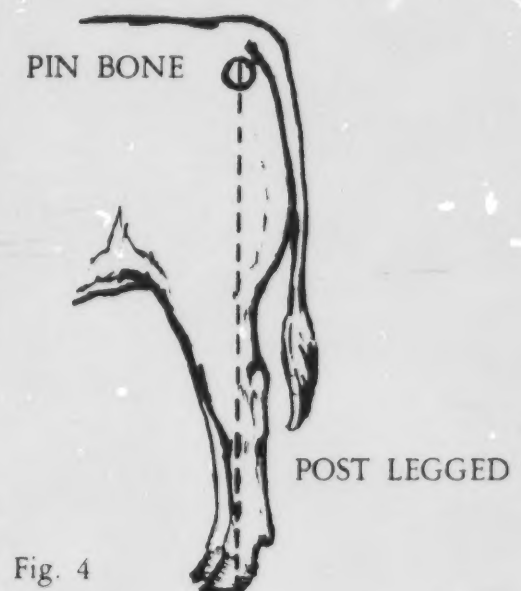
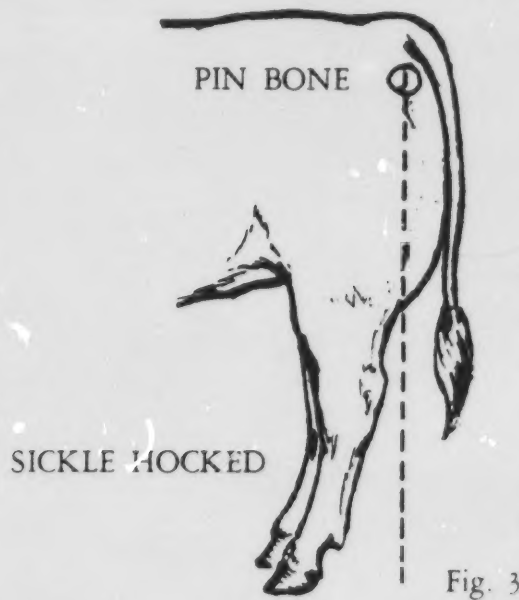
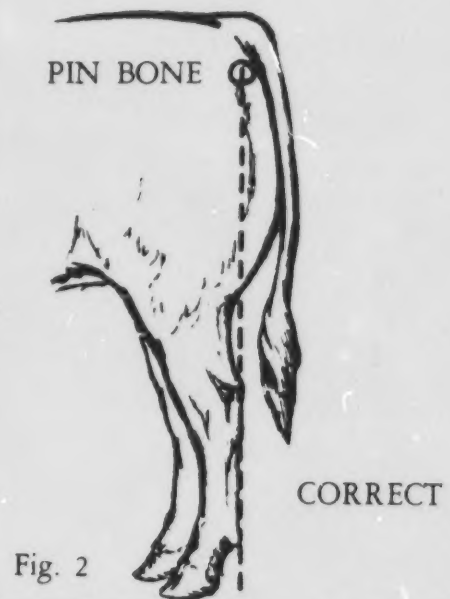


POST LEGGED



SICKLE HOCKED

SUBSTANCE OF BONE AND SET OF LEGS AND FEET



CLASSIFICATION OF CATTLE BASED ON SEX

STEERS
COWS

HEIFERS
BULLS

HEIFERETTES
STAGS

SLAUGHTER CATTLE GRADES

PRIME
STANDARD
CUTTER

CHOICE
COMMERCIAL
CANNER

GOOD
UTILITY

CLASSIFICATION OF CATTLE ACCORDING TO AGE

CALVES
COWS

YEARLINGS
BULLS

TWO-YEAR-OLDS
STAGS

HERITABILITY ESTIMATES FOR BEEF CATTLE ● CHARACTERS

CHARACTER	APPROXIMATE HERITABILITY OF CHARACTER IN PERCENT
BIRTH WT.	45%
WEANING WT.	26%
WEANING CONFORMATION SCORE	32%
DAILY RATE OF GAIN FROM WEANING TO MARKETING	46%
EFFICIENCY OF FEED UTILIZATION	39%
ON-FOOT GRADE AT SLAUGHTER TIME	38%
CARCASS GRADE	39%
AREA OF RIB EYE	70%
REPRODUCTIVE PERFORMANCE	25-30%
COW MATERNAL ABILITY (MOTHERING ABILITY AND MILK PRODUCTION)	30%
TENDERNESS	50%
FAT THICKNESS	32%
CARCASS YIELD	35%
YIELD OF RETAIL CUTS	35%

PRODUCTION RECORD FORMS

CALF & YEARLING WEIGHTS & GRADES RECORD

Sire		Dam		Calving Record		
Herd Identity Number		Age of Dam	Calf Number	Sex	Date Calved	Birth Weight

Weaning Record				
Weaning Weight	Age in Days	*Adjusted 205 Day Weight	Weight Per Day of Age	Weight Ratio or Grade

Yearling Record				
Age in Days	Yearling Weight	**Adjusted 365 Day Weight	Weight Per Day of Age	Weight Ratio or Grade

*To compute the adjusted 205 day weaning weight, apply the formula:

$$\frac{\text{actual weight} - 70}{\text{age in days}} \times 205 + 70 = 205 \text{ day weight}$$

then correct the adjusted weight for the age of the dam according to the following table:

Percent to be added to calf weights after adjusting for age	
Age of dam	Percent to be added
2	15
3	10
4	5
5-10	none
11 and older	5

**To compute the adjusted 365 day weight, apply the formula:

$$\frac{\text{final weight} - \text{actual weaning weight}}{\text{number of days between weights}} \times 160 + 205 \text{ day adjusted weaning weight} = \text{adjusted 365 day weight}$$

PRODUCTION RECORD FORMS

SIRE'S ANNUAL PRODUCTION RECORD

Sire's Herd Identity Number	Calf Number	Sex	205 Day Adjusted Weight	Weight Ratio	Grade	365 Day Adjusted Weight	Weight Ratio	Grade	Replacements	Remarks

LIFETIME PRODUCTION RECORD OF DAM

Herd Identity Number	Year of Birth	Average Total Production at Weaning				Production Index	Replacements	Remarks
		Number of Calves	Adjusted Weaning wt.	Weight Ratio	Grade			

SOEPOBJECTIVES:

Upon the completion of this unit the student will be able to:

1. To describe the relationship between SOEP and the total program of vocational agriculture.
2. To identify the values of SOEP
3. To list and describe the type and component parts of SOEP.
4. To list and describe the criteria involved in determining the appropriate type of SOEP.
5. To discuss how the major labor and wage laws affect student's employment.
6. To identify the purpose and characteristics of an SOEP plan for an individual student.
7. To plan productive enterprises for SOEP's.
8. To list some of the sources for financing productive enterprises.
9. Identify the method of obtaining a production loan.
10. Identify the major areas in which agricultural work experience may be planned and carried out.
11. Plan cooperative work experience in agriculture.
12. Keep the types of records needed by students in CWE or production.
13. Select improvement projects for inclusion in your SOEP.
14. Select supplementary skills for inclusion in your SOEP.
15. Develop a long-range SOEP plan.
16. Establish criteria for evaluating SOEP's.

References

1. Hammonds, C. and Binkley, H., Experience Programs for Learning Vocations in Agriculture. Interstate. Danville, Illinois.
2. Hammonds, C. and Binkley, H., Farming Programs for Students in Vocational Agriculture. Interstate. Danville, Illinois.
3. Phipps, L.J., Handbook on Agricultural Education in Public Schools. Interstate. Danville, Illinois.

Instructor Suggestions

1. Give students basic information through lecture or discussion.

2. Have students fill out records on their own projects or a sample one if they don't have projects yet.
3. Have older students (Juniors and Seniors) speak to the freshmen about the benefits of having a SOEP
4. Example SOEP supervision form is included at the back of this unit.

Student Activities

1. Take a field trip to observe good SOEP's of advanced students.
2. Have students develop an SOEP plan for their freshman year. This may include agricultural production, supervised laboratory, CWE and home improvement or agricultural service types of projects.
3. Have students develop a tentative long-range SOEP plan.
4. Have former students who planned and carried out successful SOEP's meet with high school classes.

Idea's For Motivating Students On SOEP

STUDENT RECORD BOOKS--AGONY OR MERELY ANGUISH

To many Vo-Ag teachers, student record books are a real pain. At the same time, most would agree that records are necessary and important. The problem, according to teachers, is that students have an inherent dislike for records and efforts to motivate them have failed. Recognizing that there are no easy answers to this dilemma, observations would lead one to believe that, with effort, the problem can be alleviated. Some suggestions:

1. Recognize that records are of value and interest only if the student has something worthwhile on which to keep records. Promote scope in SOEP's.
2. If proper scope is developed, records become essential for income tax purposes. A student can earn (save) a minimum of 20¢ for each \$1.00 of legitimate expense recorded. Don't let Uncle Sam have more than he deserves.
3. Enthusiasm in FFA can lead to better records. Records are essential for awards and degree advancement. Set goals for foundation awards and advanced degrees early and strive to attain them.
4. Students who have been taught to keep records and understand the procedures are likely to keep good records. Teach them how.
5. Students will keep good records only if their teacher demands it. They will do no more than is expected of them. Set high standrads for student records.
6. Time should be made available for maintaining records. Make it a habit to set aside the first five-ten minutes of class each Monday (or Friday) to make entries for the week. Supervise weekly record book entries.
7. In addition to weekly observation, check for neatness and accuracy and assign a grade for records every month. Records are a vital part of Vo-Ag. Grade them.

Student record books reflect the teacher's attitudes and philosophy of vocational agriculture. Take a close look at your student's records. If you don't like the image reflected, resolve to overcome the short-comings you see.

Written by Layle D. Lawrence, Vo-Ag News & Views, Vol XXVII, No. 5, Oct. & Nov., 1977.

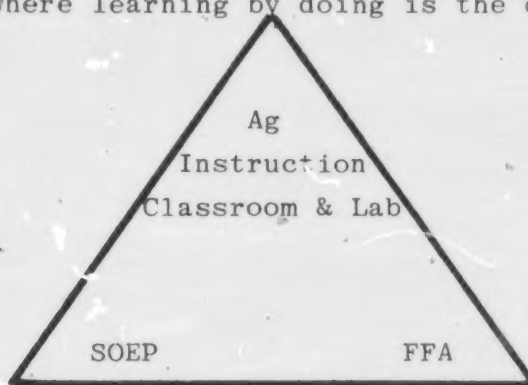
Questions and Problems for Discussion

1. What is a supervised occupational experience program?

One of the most interesting and challenging parts of the total vocational agriculture program is the supervised occupational experience program. It provides a means to "learn by doing" or in more specific terms, occupational experience programs provide for a practical application of classroom instruction, by serving as a means to apply the knowledge and skills which the student learns through the technical agriculture, agricultural mechanics and FFA portions of the program. Supervised occupational experience programs also serve as the basis for advancement and achievement in the FFA. In addition, the occupational experience program provides an opportunity for the student to become occupationally involved in agriculture under the guidance and supervision of the agriculture teacher and his/her parents and/or employer.

2. How does the supervised occupational experience program relate to the total program of vocational agriculture?

Supervised occupational experience programs are one of three parts which make up the total program of vocational agriculture in high school. The supervised occupational experience program is coordinated with technical agriculture in the classroom and instructional labs, and the Future Farmers of America to create a situation where learning by doing is the common practice.



The occupational experience program becomes an integral part of the total program of vocational agriculture. It is a part of, not a part from the total program.

3. Why have supervised occupational experience programs?

The main reason for having a supervised occupational experience program is to help the student learn. The most practical and efficient method of learning is by doing. Supervised occupational experience programs provide the opportunity to "do" what has been studied by providing a means for practical application. There are several other reasons for conducting a supervised occupational experience program; some of those reasons are as follows:

- a. Provide experience in the world of work by providing the student the opportunity to plan and carry out a job. This develops both work attitudes and skills which can not be developed in class.
- b. Develops responsibility by putting the student on his/her own and exposing them to true-life situations.
- c. Provides a means of earning money while in school. This is accomplished since the student has a part time job or is engaged in a production enterprise for profit.
- d. Provides a means for applying theory to practice or vice versa.
- e. Provides experience in record keeping.
- f. Develops technique for managing labor. By placing students in real work situations they learn proper interaction with people, and when applicable management abilities.
- g. Provides experience in saving and investing money.
- h. Develops agricultural skills and abilities, by providing the student with a means of putting to use the skills and abilities learned in the classroom.
- i. Develops reasoning and decision-making ability, by providing the students with opportunities where they must frequently reason out the proper method or practice and make a decision.
- j. Provides an avenue to get student established in an agricultural business of their own.
- k. Provides an avenue to satisfactory, progressive establishment in an agricultural occupation.
- l. Contributes to the improvement of home and community.
- m. Provides an opportunity to explore occupations by exposing the student to the broad scope of the total agricultural industry.

- n. Serves as a basis for advanced FFA degrees and awards.
- 4. What are the types of supervised occupational experience programs?

Basically there are five types of SOEP's. They are as follows:

- a. Production agriculture Projects
Examples:
 - 1. Animal projects
 - 2. Crops projects
 - 3. Soil and Conservation projects
 - 4. Farm Forestry projects
 - 5. Fish and Wildlife projects.
- b. Cooperative Work Experience Projects
Examples:
 - 1. Employed in production agriculture
 - 2. Employed in Agri-business
 - 3. Employed in Ag-Service, like Soil Conservation Office, Bureau of Land Managment
- c. Supervised Laboratory
Examples:
 - Taking care of or for housing the SOEP on school facilities (greenhouse, nursery, land lab,
- d. Agricultural Service Projects
Examples:
 - 1. Custom Hay operations
 - 2. Custom Combining
 - 3. Agriculture repair business
- e. Home Improvement
Examples:
 - 1. Build and/or repair fence
 - 2. Landscape home
 - 3. Home garden

- 5. What does a student need to do to begin planning an occupational experience program?

To begin planning a supervised occupational experience program a student should complete the following procedure:

- a. Identify an agricultural interest area for which the student wishes to train.

- b. Assess personal qualifications in light of the agricultural interest area to be pursued.
 - c. Select an appropriate type of occupational experience program, ie., productive enterprises, work experience, or a combination, which will provide training in the competencies (knowledges and skills) needed for entrance into the agricultural interest area previously identified.
 - (1) If productive enterprises are chosen, facilities must be secured, budgets must be prepared, and business agreements must be developed.
 - (2) If work experience is chosen, work stations must be identified, training plans must be developed, and employee-employer agreements must be developed.
 - d. Select improvement projects that will benefit the home, family, and/or community. Select those projects which provide a good opportunity for applying those skills already learned and for obtaining new skills.
 - e. Select supplementary agricultural skills that will contribute to the knowledge and skill essential for entry into an agricultural occupation.
6. What are the criteria which must be considered in order for students to select appropriate types of occupational experiences?

Those criteria which should be considered by students in selecting appropriate types of occupational experience programs are as follows:

a. Career objectives

The major purpose of the supervised occupational experience program is to help the student to reach a career objective to work in a chosen agricultural occupation. Therefore, the supervised occupational program must provide the opportunities to develop the knowledge and skills needed in the chosen agricultural career.

b. The home situation

The approval, support, and encouragement by a student's parents is essential to the successful conducting of a supervised occupational experience program. The parent, teacher and student build a very important relationship regarding the supervised occupational experience program.

c. Opportunities for production enterprises

Under most conditions the ideal situation for productive enterprise exists when the student is from a farm or ranch, where there is considerable

opportunities for the development of crop or livestock enterprises.

Opportunities present themselves on the basis of student need, interest and goals. The following sources as opportunities for becoming involved in a productive enterprise are available:

- 1) Leasing land, horticulture or livestock facilities in the community for carrying out either an individually owned or cooperatively owned productive enterprise.
- 2) The school land-livestock laboratory or greenhouse may provide opportunities for students to conduct either individual or group productive enterprises.

d. Availability of work experience stations

There are a variety and number of potential placement stations for gaining work experience in agriculture. Many different types of employment exist throughout a community in which the student may gain necessary competencies and experience for pursuing an agricultural occupation. Some of the opportunities for placement which should be considered are working on farms; ranches; feedlots; nurseries; businesses that buy, sell, maintain and repair agriculture machinery; businesses that buy, sell, or process agricultural products; and businesses that perform custom operations for farmers and ranchers.

e. Opportunity for successful completion

When selecting the supervised occupation experience program it is important to consider the possibility of successful completion. This is important to the student so that he will have a positive reaction to the experience and look at it as a worthwhile part of the total vocational agriculture program.

7. How do labor laws affect opportunities for work experience in agriculture?

Over the past several years the U.S. Department of Labor has developed labor laws for the protection of the individual worker. These laws include a list of hazardous occupations in agriculture in which students below the age of sixteen (16) years of age cannot be employed. These standards do not apply to a minor under 16 years of age employed by his/her parent or by a person standing in the place of his/her parent on a farm owned or operated by such persons.

8. What are the occupations in Agriculture considered to be hazardous to youth under the age of 16?

Occupations in Agriculture particularly hazardous for the employment of youth below the age of 16 are:

- (1) Handling or applying anhydrous ammonia, organic resenic herbicides, organic phosphate pesticides, halogenated hydrocarbon pesticides, or heavy-metal fungicides, including cleaning or decontamination equipment used in application or mixing of such chemicals.
- (2) Handling or using a blasting agent. For the purpose of this subparagraph, the term "blasting agent" shall include explosives such as, but not limited to, dynamite, black powder, sensitized ammonium nitrate, blasting caps, and primer cord.
- (3) Serving as flagman for aircraft.
- (4) Working as -
 - (a) Driver of a truck or automobile on a public road or highway.
 - (b) Driver of a bus.
- (5) Operating, driving, or riding on a tractor (track or wheel) over 20 belt horsepower, or attaching or detaching an implement or power-take-off unit to or from such tractor while the motor is running.
- (6) Operating or riding on a self-unloading bunk feeder wagon, a self-unloading bunk feeder trailer, a self-unloading forage box wagon, a self-unloading forage box trailer, a self-unloading auger wagon, or a self-unloading auger trailer.
- (7) Operating or riding on a dump wagon, hoist wagon, fork lift, rotary tiller (except walking type), or power-driven earthmoving equipment or power-driven trenching equipment.
- (8) Operating or unclogging a power-driven combine, filed baler, hay conditioner, corn picker, forage harvester, or vegetable harvester.
- (9) Operating, feeding, or unclogging any of the following machines when power-driven: Stationary baler, thresher, huller, feed grinder, chopper, silo filler, or crop dryer.
- (10) Feeding materials into or unclogging a roughage blower or auger conveyor.
- (11) Operating a power-driven post-hole digger or power-driven post driver.
- (12) Operating, adjusting, or cleaning a power-driven saw.
- (13) Felling, bucking, skidding, loading, or unloading timber with a butt diameter of more than 6 inches.
- (14) Working from a ladder or scaffold at a height over 20 feet.
- (15) Working inside a gas-tight type fruit enclosure, gas-tight type grain enclosure or gas-tight type forage enclosure, or inside a silo when a top unloading device

is in operating position.

(16) Working in a yard, pen, or stall occupied by a dairy bull, boar, or stud horse.

9. What provisions are made for vocational agriculture students who have been trained in safe operation of equipment?

In 1969, provisions were made for a change to be made in the area of hazardous occupations for youth in agriculture. The change applies to youth who hold certificates verifying that they have successfully completed vocational agriculture training programs in safe tractor operation or safe farm machinery operation approved by the U.S. Department of Health, Education, and Welfare. Successful completion of such programs includes passing both a written and a practical test. The tractor driving unit at the beginning of this guide was designed to meet those standards. Contact the County Extension Service to determine procedures for certifying students who successfully complete this instruction.

10. What is an occupational experience program plan?

An occupational experience program plan is a listing of the productive enterprises and/or supervised agricultural work experience plus a listing of improvement projects and supplementary skills which a student plans to carry out during a given year in high school.

The plan includes the scope, the percentage of student ownership, and the degree of responsibility which the student will have for each productive enterprise he/she plans to carry out.

A sample plan for occupational experience in agriculture for a student for one year follows:

PLAN FOR OCCUPATIONAL EXPERIENCE PROGRAM IN AGRICULTURE

___ School Year

PRODUCTION ENTERPRISES	WORK EXPERIENCE	IMPROVEMENT PROJECTS	SUPPLEMENTARY SKILLS
3 feeder beef - 100% ownership and responsibility	200 hrs. work for neighbor as General Farm Hand during summer.	Plan and install automatic watering system for home grounds.	Horizontal welding Verticle welding Castrate lambs Dock lamb tails Vaccinate for White Muscle
10 acres barley- 50% ownership and 100% responsibility - in partnership on neighbor's land		Repair and repaint home.	

11. What is the purpose of a student's individual plan for occupational experience in agriculture?

The major purpose of a student's individual plan for occupational experience in agriculture is to assist the student, teacher, and parents as the student considers, selects, and carries out worthwhile out-of-school agriculture activities. These activities are planned to help the students with the necessary agricultural competencies (knowledge and skill), attitudes, and managerial abilities which they will need in order to pursue chosen careers in agriculture.

The occupational experience program plan serves as the focal point for discussion between the teacher, student, parent and/or other parties concerned as more detailed plans are made and the occupational experience program is carried out by the individual student.

Finally, the plan provides a sound basis for identifying the subject matter in agriculture that should be taught in the classroom in an attempt to meet the needs, interests, and occupational goals of the students enrolled in the vocational agriculture program.

12. What are the characteristics of a well-planned occupational experience program in agriculture?

There may be considerable variation in the number, kind, and scope of activities which students include in their occupational experience program. This variety will be necessary because of differing goals of students as well as differing opportunities available to students as they plan and conduct an occupational experience program. There are, however, certain characteristics common to all good agricultural experience programs. Some of the characteristics of a desirable supervised occupational experience program are:

- a. It should be of sufficient scope and difficulty to be challenging to the student.
- b. It should provide for the development of a large number of needed abilities essential to success in agricultural occupations.
- c. It should contain productive and/or work experience projects of a size that will provide for the student to make a satisfactory profit or wage.
- d. It should contain a balance of productive projects and/or work experience, improvement projects, and supplementary skills.
- e. It should result in the adoption by the student of a considerable number of approval practices.

- f. It should lead to the establishment in an agricultural occupation.
- g. It should contribute to family living through the development of improvement projects at the home.
- h. It should demand the respect of the student, the parents, and the community.
- i. It should provide opportunity for expansion each year.

13. What is a long-range occupational experience program plan?

A long-range occupational experience program plan is a listing, by years, of the productive enterprises, agricultural work experience, improvement projects, and/or agricultural service which a student plans to conduct during his/her four years in vocational agriculture. In many cases these plans will be extended to cover the years immediately following high school.

The plans for each year should build and expand upon the plans of the preceding year. As each year is completed, accomplishments must be reviewed and the long-range plan evaluated and revised in the light of these accomplishments.

Long-range plans should be tentative thus allowing students the opportunity to change their minds and change direction.

14. Why should each student develop a long-range plan for his/her occupational experience program?

Long-range plans are essential to a student's occupational experience program to aid the student in becoming successfully established in an agricultural occupation. Long-range planning is important to the student, it gives him/her a sense of direction and serves as a motivating force. It also shows what direction he/she must pursue to acquire the training needed for his/her chosen field. Long-range plans provide a means for planning participation in the FFA program. They help in the correlation of all the major parts of the vocational agriculture program to the supervised occupational experience program.

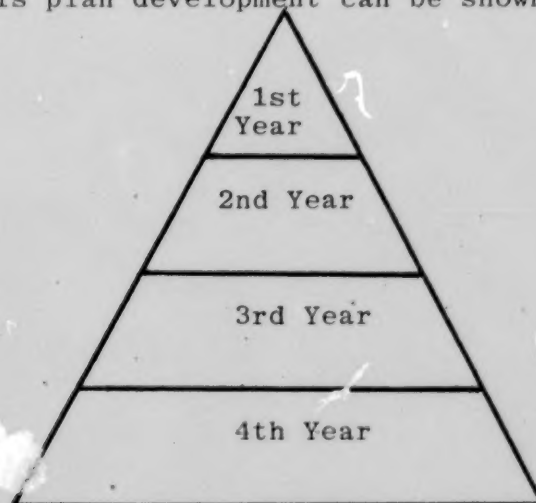
Altogether planning a long-range occupational experience program helps the student to look ahead and to establish goals. Working toward those goals the student will select combinations of productive enterprises, work experience, improvement projects and/or service projects which will, help him/her to acquire the necessary skills, experience, and capital to enter his/her chosen occupation.

15. When is the long-range occupational experience program plan developed?

Long-range occupational experience program plans are developed by the student during his/her first semester of vocational agriculture and are revised each year thereafter. Such plans must be sufficiently flexible to provide for needed changes and additions as the program continues. Because as the student moves through his/her program opportunities and goals will change from time to time and he/she needs a flexible program to allow for this.

16. What are some examples of long-range occupational experience program plans?

Long-range occupational experience program plans should build in size and/or scope (diversity) year by year. This plan development can be shown as follows:



Long-range occupational experience programs often start on a small scale due to the opportunities and abilities of the student. The programs are then expanded each year based on the development and achievement of the student. This expansion is due to continuation and expansion of some activities and the addition of new enterprises, work experience, and/or improvement projects.

The following is an example of a long-range occupational experience program of a student who aspires to become a farm manager.

LONG RANGE OCCUPATIONAL EXPERIENCE PROGRAM IN AGRICULTURE

YEAR	PRODUCTION ENTERPRISES	WORK EXPERIENCE	IMPROVEMENT PROJECTS	SUPPLEMENTARY SKILLS
1st	20 feeder swine - 10% interest and responsibility in Vo-Ag class project.	200 hrs. work for neighbor during summer as General Farm Hand.	Establish and maintain a lawn at home. Repair corrals and build new gates at home.	Soil testing. Make orthographic drawing. Sprayer calibration. Tractor Operation.
2nd	5 feeder steers - 100% ownership and responsibility. 10 acres barley - 10% interest and responsibility in Vo-Ag class project.	200 hrs. work for neighbor as General Farm Hand.	Fence backyard at home. Repair and repaint home.	Castration of pigs. Arc Welding - Flat & Horizontal Oxy-Acetylene welding Flat & Horizontal. Ration formulation for poultry.
3rd	10 feeder steers - 100% ownership and responsibility. 15 acres barley - 100% ownership and responsibility on rented land.	200 hrs. work for neighbor as General Farm Hand. 60 hrs. managing school Swine Feeding Enterprise.	Build portable loading chute for livestock. Install automatic watering system for home yard.	Hard facing farm equipment. Mower adjustment. Arc Welding & Oxy-Acetylene-Vertical. Countour Mapping.
4th	10 feeder steers 15 acres barley 10 acres cotton 100% ownership and responsibility.	100 hrs. managing school barley enterprise. 320 hrs. as Ag. Mechanics Helper during summer.	Recondition 2 pieces of machinery for neighbor.	Arc Welding-Overhead position. Installing three-way switch. Repair and overhaul of small gas engines. Mix, place and finish concrete.
5th		180 hrs. work at Community College Farm. 400 hrs. work as Farm Foreman for neighbor during summer.		

300

310

17. How should a student's supervised occupational experience program be evaluated?

Supervised occupational experience programs in agriculture should be evaluated as to the degree to which the student's program provides the student the opportunity to gain the needed skills to move towards his/her chosen agricultural occupation. In addition the program should be evaluated as to whether or not the student actually gained new agricultural skills; learned to make management decisions; and kept adequate records. The program should assist the student in moving toward his vocational goal, by providing experiences and developing investment and/or capital for moving into the occupation or pursuing further education requirement.

18. Who should evaluate the student's occupational experience program in vocational agriculture?

Evaluating a student's occupational experience program is part of his/her overall evaluation for vocational agriculture. The evaluation of the supervised occupational experience program is important and it should not be left strictly in the hands of the teacher. In order to derive the greatest benefit from the program, the student; the parents; the employer, in the case of work experience program; and the teacher should all be involved in the evaluation of the student's occupational experience program. The student should evaluate the program in the light of what he/she wants to achieve, is he/she satisfied with what he/she is doing. The parent evaluates in the light of the student accepting his/her responsibility and overall attitude. The teacher evaluates on the basis of skill and knowledge acquired on the part of the student and on the records kept. In the case of work experience programs, the employer assists the teacher in evaluating the knowledge and skills learned and applied by the student in a real job situation. The vocational agriculture teacher should not turn the job of supervision over to a general CWE coordinator. The vocational agriculture teacher must be involved with supervision in order to maintain program quality and maintain contact with the industry.

19. What are some criteria which should be used in evaluating a student's occupational experience program in agriculture?

Some of the major criteria to use in evaluating supervised occupational experience programs in agriculture are as follows:

- a. Complete and accurate records were kept.
- b. Number, scope, and quality of improvement projects completed.

- c. Number of supplementary agricultural skills completed.
- d. Program adequately challenges student.
- e. Correlation between occupational experience program and occupational choice.
- f. Advantage taken of opportunities for improving program both in scope and diversity.
- g. Recommendations which have been agreed upon for improving the quality, scope, or efficiency of program were carried out.

20. Record of supervision for students SOEP's

Four copies of the supervision form are normally completed and to be used as follows:

- a. One copy for the student.
- b. One copy mailed to the parents.
- c. One copy for the teacher's use and records.
- d. One copy to be forwarded to the school district administrator who the vocational agriculture teacher reports to.

An example form follows:



AgI-VII-17

VOCATIONAL AGRICULTURE DEPARTMENT

Supervision Report

STUDENT NAME: _____ DATE: _____

TRAVEL INVOLVED IN VISITATION: _____ miles

LENGTH OF VISITATION: _____ hrs. _____ min.

VISITATION SITE: _____ SCHOOL _____ HOME _____ OTHER

WAS PARENT CONTACTED DURING VISIT? _____ YES _____ NO

DESCRIPTION OF STUDENTS S.O.E.P:

ACTIVITIES ACCOMPLISHED DURING VISITATION:

RECOMMENDATIONS FOR PROJECT IMPROVEMENT:

RECOMMENDATIONS AND EVALUATION OF RECORD BOOK:

	OK	Needs Work
Agreements		
Budgets		
Inventories		
Dairy & Labor		
Journal		
FFA Records		

STUDENT SIGNATURE _____ ADVISOR SIGNATURE _____

White - Instructor Yellow - Parent Pink - Principal Green - Student

Oregon Project Record Book

A guide for the Oregon Project Record Book is being developed by John Oades, Oregon State University. It was not complete as of the publication of this document. Therefore, write or call John Oades for information regarding the availability of an instructional unit on the Oregon Project Record Book.

John Oades
Bat. 202
Oregon State University
Corvallis, Oregon 97331

Phone: 503-754-3681

PARLIAMENTARY PROCEDURE

OBJECTIVES:

Upon completion of this unit, the students will be able to:

1. List two principles upon which parliamentary procedure is based.
2. Select from a list three characteristics of a good chairman.
3. Match types of motions with the appropriate definition.
4. Write the characteristics of the kinds of motions used in conducting a meeting.
5. List the ranking order of motions and be able to identify when motions are out-of-order.
6. Identify the vote required for passage of various motions.
7. Discuss and debate motions presented in a logical, orderly fashion.
8. Demonstrate the ability to use parliamentary procedure correctly.

INSTRUCTOR ACTIVITIES:

1. Motivate students to learn Parliamentary Procedure. (See page 2)
2. Discuss terminal and specific objectives.
3. Provide students with "Parliamentary Procedure Made Easier."
4. Discuss study guides.
5. Have students conduct a business meeting using correct parliamentary procedure.
6. Give test.
7. For current Parliamentary Procedure State Contest Guide write to Gordan Galbraith, 700 Pringle Parkway S.E., Salem, Oregon 97310.

STUDENT ACTIVITIES:

1. Participate in discussion.

2. Study text and complete study guide (a study guide is provided at the back of this unit).
3. Participate in discussion in a simulated business meeting and serve as chairman at least once.
4. Take test.

REFERENCES:

1. Parliamentary Procedure Made Easier. Extension Circular 947, ASWSU Activities Center, Washington State University, Pullman, Washington, 99163. 50¢ per copy. (purchase one for each student and use as a text).
2. FFA Student Handbook
3. Rules of Order and Parliamentary Procedure. Roberts, Henry M.
4. A Guide to Parliamentary Practices. Henderson, Melvin and Rucker, H.J.

SUGGESTIONS FOR TEXT:

The material presented in this outline is derived from "Parliamentary Procedure Made Easier" which should be purchased as the student text and is available from:

ASWSU Activities Center
Washington State University
Pullman, Washington 99163

The cost of this publication is 50¢ per copy.

MOTIVATION: (Several are listed. Select one or two which fit your needs and style of presentation)

1. How many of you have attended a meeting (club or organization)?
 - a. Was business conducted in a fast, orderly, efficient manner?
 - b. Why was it-or-why wasn't it?
2. How many of your dads are involved in an organization?
 - a. Do the meetings run smoothly?
 - b. Why or why not?
3. Are you planning on, or currently in, some organization?

a. How are the meetings run?

Conclusion to any of the above:

Do you feel that parliamentary procedure correctly used will help meetings run in a more orderly, efficient manner?

The Purpose of Parliamentary Law

1. To enable an assembly to transact business with speed and efficiency.
2. To protect the rights of each individual.
3. To preserve a spirit of harmony within the group.

To achieve these purposes, always consider the five basic principles of parliamentary procedure:

1. Only one subject may claim the attention of the assembly at one time.
2. Each proposition presented for consideration is entitled to full and free debate.
3. Every member has rights equal to every other member.
4. The will of the majority must be carried out, and the rights of the minority must be preserved.
5. The personality and desires of each member should be merged into the larger unit of the organization.

The Agenda or Order of Business

It is customary for every group to adopt a standard order of business for meetings. When no rule has been adopted, the following is the order:

1. Call to order
"Will the meeting please come to order."
2. Reading and approval of minutes
"Are there any corrections to the minutes?"
"There being no corrections, the minutes will stand approved as read."

OR

"Are there any further corrections to the minutes?"
"There being no further corrections, the minutes will stand approved as corrected."

3. Reports of officers and standing committees
Officers, boards, or standing committees should be called upon to report in the order in which they are mentioned in the constitution or by-laws of the organization.

4. Reports of special committees
5. Unfinished business
"We come now to unfinished business. Is there any unfinished business to come before the meeting?"
6. New business
"Is there any new business to come before the meeting?"
7. Program
8. Adjournment
Unqualified form: Proposer moves for adjournment; motion is seconded; chair calls for a vote; action depends upon majority vote. This motion cannot be discussed.

Qualified form: Proposer moves for adjournment within a definite time or adjournment to meet again at a specified time; motion is seconded; chair calls for discussion; a vote is taken; action depends upon majority vote.

The Motion

A motion is a proposal that the group take certain action.

HOW ARE MOTIONS CLASSIFIED?

Main Motions - Motions of this group have for their object the bringing of the questions, or propositions, before the assembly for consideration. Only one main motion can be considered at a given time by the assembly, and such a motion, when introduced, excludes all other main motions until it has been disposed of.

Subsidiary Motions - Motions of this group have for their object the modification or disposition of the main motion that is being considered. Their existence as motions depends entirely upon the principle motion to which they are subordinate. Since they relate to the question before the house, it is "in order" to propose them when a main motion is still before the assembly and to vote upon them before voting upon the main motion.

Privileged Motions - Motions of this group have no connection whatsoever with the main motion before the assembly, but are motions of such importance that they are entitled to immediate consideration. These motions have the privilege of setting aside temporarily the main business before the house.

Incidental Motions - Motions of this group have few general characteristics in common, but for convenience have been grouped into one class. The name, "incidental," has been chosen because they arise only incidentally out of business of the assembly.

See pages 10 and 11 for a Chart of Precedence of Motions and a Summary of Rules Governing Them.

HOW SHOULD A MOTION PROGRESS?

1. A member rises and addresses the presiding officer.
The presiding officer should be addressed by the appropriate title, i.e., "Mr./Madame President." If the specific title is not known, it is always correct to use the term "Mr./Madame Chairman (or Chairperson)."
2. The member is recognized by the presiding officer.
The chair recognizes a member by name, by a nod, or other means of recognition. Having thus received formal recognition from the chair, a member is said to "have the floor" and is the only member entitled to present or discuss a motion.
3. The member proposes a motion.
A motion is always introduced in the form, "I move that" followed by a statement of the proposal. This is the only correct phraseology. Aside from very brief explanatory remarks, it is not permissible to discuss the merits of a motion either prior to, or immediately following, the formal proposal of the motion. All discussion must wait until after the chair has stated the motion to the assembly and has called for discussion.
4. Another member seconds the motion.
Another member, without rising or addressing the chair, may say, "I second the motion." Seconding a motion is merely an indication that the member seconding it wishes the matter to come before the assembly for consideration. If no one seconds the motion, the chair may ask, "Is there a second to the motion?" If there is none, the chair may declare, "The motion is lost for want of a second."
5. The presiding officer states the motion to the assembly.
When a motion has been properly proposed and seconded, the presiding officer repeats the motion to the assembly, or "states the motion." After it has been formally stated to the assembly, it may be spoken of as a "question," a "proposition," or a "measure".
6. The assembly discusses or debates the motion.
After the motion has been formally stated, any member has a right to discuss it. The floor must be obtained in the same manner as when presenting a motion. Normally, the first person who asks recognition is entitled to speak, but when several members wish to speak or present motions at the same time, certain guiding principles should determine the decision of the chair:
 - a. The chair should always show preference to the proposer of the motion.

- b. A member who has not spoken has prior claim over one who has already discussed the question, or who has proposed another motion.
- c. If the opinions of the various members are known, regarding the measure before the house, the chair should alternate between those favoring the measure and those opposing it.
- d. The chair should recognize a member who seldom speaks in preference to one who frequently claims the attention of the assembly.

Discussion must be confined to the question that is "before the house."

- 7. The presiding officer takes the vote on the motion. When all members who desire to discuss the question have done so, the motion is "put to a vote." It is permissible, before taking the vote, to inquire "Is there any further discussion?" or "Are you ready for the question?" If no one rises, it is presumed discussion is closed. The presiding officer will proceed to take the vote by announcing, "All in favor of the motion (state the motion) say 'Aye.'" Following response from the assembly, the presiding officer will say "Those opposed say 'No.'" If it is not possible to determine from the volume of voices which way the majority has voted, the response is: "The chair is in doubt. Those in favor of the motion please rise." After counting: "Be seated. Those opposed, rise. Be seated." Another alternative is to simply call for a show of hands. Certain motions may be voted on by ballot.
- 8. The presiding officer announces the result of the vote. The chair then formally announces the result of the vote, saying: "The motion is carried; therefore (state the intent of the motion)." If a majority voted in the negative, "The motion is lost." As soon as the vote has been announced, another motion is in order.

HOW MAY A MOTION BE AMENDED?

The purpose of the motion to amend is to modify a motion that has already been presented in such a manner that it will be more satisfactory to the members.

Methods of Amending

- 1. By addition or insertion - To add something to the motion which it did not contain.
- 2. By elimination or by striking out - To subtract or eliminate something from a motion that was originally a part of it.

3. By substitution - This method is a combination of the first two methods, since in amending by substitution something is stricken out and something inserted in its place.

The substituted portion may consist of a work, a phrase, a clause, or an entirely new motion.

The most important principle to understand in connection with any form of the motion to amend is that an amendment "may be hostile, but it must be germane."

"Hostile" means opposed to the spirit and aim of the motion to which it is applied.

"Germane" means having direct bearing upon the subject matter of the motion; that is, relevant, or relating to it.

An amendment may be opposed to the actual intent of the original motion and, in fact, nullify it, but if it relates to the same subject matter, it is germane.

HOW TO HANDLE AMENDMENTS

Types of Amendments

1. Amendment of the First Rank - An amendment to the motion.
2. Amendment of the Second Rank - An amendment to the amendment. (The amendment to the amendment must modify and relate directly to the amendment and NOT to the main motion, otherwise it is out of order.)

No amendment beyond that of second rank is possible.

It is never in order to propose more than one amendment of each rank at one time. If one desires to amend two separate and unrelated parts of a motion, this must be done by two amendments of the first rank, and one must be voted upon before the other is proposed. It is possible, however, to have a motion, one amendment to the motion (amendment of the first rank), and one amendment to the amendment (amendment of the second rank) before the assembly at once. Until the amendment of the second rank has been voted upon, no other amendment of the second rank is in order. Until the amendment of the first rank has been voted upon, no other amendment of the first rank can be proposed.

Order of Voting

Amendments are voted upon in inverse order; that is, the one of second rank is disposed of first.

1. Discussion is held and the vote taken upon the amendment to the amendment (amendment of second rank).
2. Discussion is called for and the vote is taken upon the amendment to the motion (amendment of first rank).

3. When the vote on this has been taken, discussion upon the original or main motion as amended is opened and when completed a vote is taken upon it.

Nominations and Elections

A nomination is the formal presentation to the assembly of the name of a candidate for the office to be filled.

1. Nominations From the Floor:
 - a. Nominations do not require a second.
 - b. Nominations are in order as soon as the chair calls for them.
 - c. As a nomination is made, the chair repeats it and the secretary records it.
 - d. No member may nominate more than one candidate for each office.
 - e. If there are no further nominations, the chair may declare the nominations closed.
 - f. A motion to close the nominations require a two-thirds vote.
 - g. Prior to voting, but following the formal closing of nominations, nominations may be reopened by a motion, which requires only a majority to carry.
2. Nominations by Nominating Committee:
 - a. Committee may be appointed or elected as the assembly may choose or as stated in the by-laws.
 - b. Nominating committee report presents to the organization the names of one or more members as candidates for each office.
 - c. The report of the nominating committee is not adopted, but the names are posted and treated as if the persons named had been nominated from the floor.
 - d. Further nominations may be made from the floor.

CHART OF PRECEDENCE OF MOTIONS AND SUMMARY OF RULES GOVERNING THEM

	May Inter- rupt a Speaker	Requires a Second	Debatable	Vote Required	Motions that May Apply
Privileged Motions					
1. To fix time to which to adjourn	No	Yes	Limited	Maj.	Amend, Reconsider
2. To adjourn (unqualified)	No	Yes	No	Maj.	None
3. To take a recess	No	Yes	Limited	Maj.	Amend
4. To rise to a question of privilege	Yes	No	No	Chair rules	All
5. To call for the orders of the day	Yes	No	No	None	None
Subsidiary Motions					
6. To lay on the table	No	Yes	No	Maj.	None
7. To call for the previous questions	No	Yes	No	2/3	Reconsider
8. To limit, or extend limits, of debate	No	Yes	Limited	2/3	Amend, Reconsider
9. To postpone definitely	No	Yes	Limited	Maj.	Amend, Recon., Prev. Ques.
10. To refer to a committee	No	Yes	Limited	Maj.	Amend, Recon., Prev. Ques.
11. To amend	No	Yes	Yes	Maj.	Amend, Recon., Prev. Ques.
12. To postpone indefinitely	No	Yes	Yes	Maj.	Limit Deb, Prev. Ques., Recon.
Main Motions					
13. a. General main motions	No	Yes	Yes	Maj.	All
b. Specific main motions					
To take from the table	No	Yes	No	Maj.	None
to reconsider	Yes	Yes	Yes	Maj.	Lim. Deb., Prev. Ques., Table, Postpone definitely
				None until	
To reconsider and have entered on the minutes	Yes	Yes	No	called for	None
To rescind	No	Yes	Yes	2/3	All
To expunge	No	Yes	Yes	2/3	All
To adopt a resolution	No	Yes	Yes	Maj.	All
To adjourn (qualified)	No	Yes	Limited	Maj.	All
To create orders of the day (Special)	No	Yes	Yes	Gen., Maj.; Spec.	All
				2/3	
To amend (constitution, etc.)	No	Yes	Yes	2/3	All
Incidental Motions					
To suspend rules	No	Yes	No	2/3	None
To withdraw a motion	No	No	No	Maj.	Reconsider
To read papers	No	Yes	No	Maj.	Reconsider
To object to a consideration	Yes	No	No	2/3	Reconsider
To rise to a point of order	Yes	No	No	Chair rules or Maj.	None
To rise to parliamentary inquiry	Yes	No	No	None	None
To appeal from the decision of the Chair	Yes	Yes	Limited	Maj.	All except amend
To call for a division of the house	Yes	No	No	Maj.	None
To call for a division of a question	No	Yes	No	Maj.	Amend

3. Nominations by Ballot:

- a. Chair directs tellers to pass out ballots, and members write after each office the name of one person they desire to nominate.
- b. If a candidate receives a majority in this manner, it is usual to declare that candidate elected.
- c. If no majority is received, a second ballot is then taken, in which candidates nominated by previous ballot are voted upon. If a candidate receives a majority on this ballot, election is declared.
- d. If no one is elected on the second ballot, a motion that only the two highest candidates on the previous ballot be considered on the next ballot is in order before this third ballot. The third ballot then becomes the decisive vote, or the electing ballot.

4. Voting For Candidates Not Nominated:

Voters may vote for anyone who is eligible regardless of whether or not that person has been nominated, and anyone receiving the necessary majority is elected. This is commonly called a "sticker ballot."

5. Voting on Nominations:

- a. After the nominations are closed, the assembly proceeds to vote upon the names by the method prescribed in the constitution.
- b. An election becomes effective immediately, if the candidate is present and does not decline, or is absent but has consented to the candidacy. If the nominee is absent and has not consented to the nomination, the election becomes effective as soon as notification is made, if it is not declined immediately.
- c. Unless some other time is specified in the by-laws, an officer assumes the duties of the office upon election.

Most organizations make specific detailed provisions for nominating and electing new officers in their constitution and by-laws. The provisions ordinarily include such details as time of nominations, time of elections, method of nominating and electing, and time of installation.

ACTION FOR SPECIAL PURPOSES

Kind of motion	Object	Effect
To lay on the table	Clear the floor for more urgent business	Delays action
To call for the previous question	Secure immediate vote on pending question	Ends debate
To limit or extend time for debate	Provides more or less time for discussion	Shortens or lengthens discussion period
To postpone definitely (to a certain time)	Often gives more time for informal discussion and for securing followers	Delays action
To commit or refer	To enable more careful consideration to be given	Delays action
To amend	To improve the motion	To change the original motion
To postpone indefinitely	To prevent a vote on the question	To suppress the question
To raise a point of order	To call attention to violation of rules	Keeps group functioning according to parliamentary procedures
To appeal from the decision of the chair	To determine the attitude of the group on the ruling made by the chair	Secures ruling of the group rather than by the chair
To suspend the rules	To permit action not possible under the rules	Secure action which would otherwise be prevented by the rules

ACTION FOR SPECIAL PURPOSES

Kind of motion	Object	Effect
To object to the consideration of a question	Prevent wasting time on unimportant business	Suppress the motion
To divide the question	Secure more careful consideration of parts	Secures an accurate check on vote
To call for a division	(a) To determine the accuracy of a <u>viva voce</u> vote (b) To secure expression of individual members' vote	Secures an accurate check on vote
To nominate	Suggest names for office	Places before the group names for consideration
To make a request growing out of pending business	To secure information or ask to be excused from a duty	Provide information
To fix the time to which to adjourn	To have legal continuation of the meeting	Sets definite continuation time
To adjourn	End the meeting	Adjourns the meeting
To take a recess	To secure an intermission	Delays action
To raise a question of privilege	To correct undesirable conditions	Corrects undesirable condition
To call for the order of the day	To secure adherence to order of business	Same as object

ACTION FOR SPECIAL PURPOSES

Kind of motion	Object	Effect
To take from the table	Continue the consideration of the question	Continue consideration of question
To reconsider (Only a member of the prevailing side may make this motion)	To reconsider the question	Secures further consideration and another vote on the question
To reconsider and have entered on the minutes (Only a member of the prevailing side may make this motion)	To reconsider the question at the next meeting	Secures further consideration and another vote on the question
To rescind	Repeal action previously taken	Same as object
To ratify	Approves previous action taken	Same as object

GLOSSARY OF STANDARD TERMS

Amend. To change a motion either by adding to it, taking from it, or by altering it in some other way. (See Amendments.)

Blanks, Filling. "Filling blanks" is a term used to indicate a method of decision regarding a matter where several different courses of action are possible. The term "blank" is used because usually this method is applied in motions where an exact amount, a name, a date, or some other essential, specific information is left blank.

Business, Order of. The regular program of procedure of a Society. (See Agenda.)

Chair. The presiding officer. "Addressing the chair" means speaking to the presiding officer. This is done by rising to one's feet (or raising a hand) when no one else is speaking (with some exceptions) using the proper salutation, i.e., "Mr./Madame Chairman." Being "recognized by the chair" means being given permission to speak further. (See Progress of Motions.)

Power of Chair. The chair has the following authority:

- a. To decide in what order speakers shall be recognized.
- b. To refuse to recognize members offering dilatory, absurd, or frivolous motions or motions intended, in his judgment, to obstruct business.
- c. To restrain speakers within the limits of the rules.
- d. To enforce good decorum.
- e. To appoint committees.
- f. To decide points of order.
- g. To vote in cases where the vote would change the result; e.g., to make or break a tie.
- h. To avoid influencing a vote by comment on a motion under consideration.

Actions of the chair are, of course, subject to appeal (See Incidental Motion, "to appeal from the decision of the chair.")

Commit. To refer to a committee.

Committee of the Whole. Sometimes certain matters come up which can be properly studied and digested only as a committee would go into them, but which, because of their importance, should be considered by all members, and therefore should not be referred to a small committee. Then the meeting, on motion duly made, may "resolve itself into a committee of the whole." This means that the meeting officially is discontinued while everyone remains and becomes a member of a large special committee including everyone present. The presiding officer of the regular meeting does not preside over a committee of the whole; a special officer is appointed.

Consideration, Informal. When a member moves "informal consideration," and the motion is adopted, the meeting lays

aside formal rules, allowing each present to speak once on the subject under consideration.

Debate. Discussion or argument over a motion.

Division. "Division" in parliamentary law means simply a vote whereby all who are in favor and all who are opposed to a motion stand separately in groups as the chair calls for "ayes" and "nays".

Floor. The privilege of speaking before the assembly. Thus, when one "obtains the floor," the opportunity to speak is granted.

Inquiry, Parliamentary. An investigation or checking to determine the proper course of procedure.

Motion. A formal proposal to a meeting that it take certain action. A motion is a "motion" when stated by its proponent and until repeated by the chair when presented by the chair for acceptance or rejection, at which time it becomes a "question," a "proposition," or a "measure." (See Progress of Motions.)

Motion, Incidental. An incidental motion is one growing out of another already under consideration. The secondary motion must be disposed of before proceeding with the original motion. (See Motions.)

Motion, Main. A main motion is one which independently presents an idea for consideration. (See Motions.)

Motion, Privileged. A privileged motion is one which is so vital in character that it takes precedence over all others. (See Motions.)

Motion, Subsidiary. A subsidiary motion is one growing out of and applied to another already under consideration which is made use of "to enable the assembly to dispose of it in the most appropriate manner," but which need not necessarily be decided before the question out of which it has arisen. (See Motions.)

Order. When this term is applied to an act of an assembly it means an expression of a will of the assembly in the form of a command. An "order" differs from a "resolution" in that the latter is not a command, but a declaration of fact or an expression of opinion or purposes.

Order, General. "Making a general order" is setting a future time for the discussion of a special matter. Making a general order differs from making a special order in that the former does not involve the breaking of any rules.

Order of the Day. Regular order or program of business. A motion "calling for the orders of the day" is a motion

demanding that the present discussion be dropped and that the chair announce the next matter to be taken up in accordance with the organizations customary and established business routine. The term "orders of the day" has more specific meaning when a certain time has been set aside for the consideration of a given matter. Then a demand for the "orders of the day" is a request that this specific thing be taken up at the time set for it.

Order, Special. "Making a special order" is setting aside all rules for the consideration of some important question at a future time.

Postponement, Indefinite. This term is clear in the ordinary meaning of the words included in it except that the object of indefinite postponement is not merely to postpone, but, in effect, to reject.

Privilege. The term "privilege" in parliamentary law has a restricted meaning and refers specifically to the privileges or rights of the meeting or those attending chiefly in connection with matters of physical comfort; such as inability to hear a speaker, the heating, lighting, and ventilation of the meeting room, noises and other disturbances, etc.; and the ineligibility or misconduct of a member in a meeting at the time. These "questions of privilege" may be involved in motions, but privileged motions include other matters.

Question. The question in parliamentary law is the proposition or motion after it has been placed before the meeting for action by the chair. To "move the previous question" is to demand that the chair take a vote on a motion which is being discussed. A "question," when adopted becomes an "order," "resolution," or "vote." (See Motions.)

Question, Division of. To separate a motion so that different parts of it may be considered individually.

Refer. To refer to a committee.

Resolution. The act of an assembly, the purpose of which is to declare facts or express opinions or purposes, and not to command. (See section on Order.)

Rules, Suspension of. "When the assembly wishes to do something that cannot be done without violating its own rules, and yet is not in conflict with its constitution or by-laws, or with the fundamental principles of parliamentary law, it suspends the rules that interfere with the proposed action."--Robert.

Second. A motion, in order to be considered by the meeting, must have a "second," i.e., a sponsor in the form of a second member who indicates support of the motion by saying "I second the motion." (See section on Motions.)

Sine die. Latin meaning "without day." Meetings frequently adjourn "sine die." This means that no date is set for a future meeting.

Table. The "table" in parliamentary law is literally the speaker's table, but to "lay on the table" or "to table" a motion means to delay action on it.

STUDY GUIDE I: (Page 3 - Page 7)

1. List the purpose of parliamentary law.
 - a.
 - b.
 - d.
2. Identify the basic principles of parliamentary law.
 - a.
 - b.
 - c.
 - d.
 - e.
3. List the items, in order, which should be on an agenda.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.
4. How many main motions can be on the floor at one time?
5. What is the purpose of a main motion?
6. What is the purpose of a subsidiary motion?

7. What is the purpose of a privileged motion?
8. What is the purpose of an incidental motion?
9. Give the correct order for a motions progress through a normal business meeting.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.

STUDY GUIDE II: (Page 7-17)

1. How may motions be amended?
 - a.
 - b.
 - c.
2. An amendment may not change the original _____ of a motion.
3. How many times may an amendment be amended and be on the floor at one time?
4. List the three ways to nominate an individual for office.
 - a.
 - b.
 - c.
5. Fill in the chart from page 10 for your own study.
6. List the seven subsidiary motions below and identify their object, or purpose, and the effect they have on the main motion to which they are applied.

Kind of MotionObjectEffect

a.

b.

d.

e.

f.

g.

7. What is the correct way to present a main motion?
8. Why don't we say, "I make a motion that"?

9. Four items must be specified in a referral: (1) Number in committee, (2) Who's to appoint the committee, (3) what power they have, and (4) when they are to report back. Write a correct referral.
10. When you feel the chair has incorrectly ruled against your point of order what is your recourse?
11. Define the following terms:
- a. Power of Chair
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
 - 8.
 - b. Floor
 - c. Order
 - d. Order of the Day
 - e. Question
 - f. Resolution

Table of Motions and Rules That Apply to Motions (List in order or rank)

MOTIONS	May Interrupt Speaker	Required Second	Debatable	Vote Required	Motions that May Apply
---------	-----------------------------	--------------------	-----------	------------------	---------------------------

A. Privileged

1. To fix time
2. To adjourn
3. To take a recess
4. Question of priv.
5. Orders of Day

B. Incidental

1. Point of order
2. Appeal
3. Suspend rules
4. Object to consider
5. Division of house
6. Division of question
7. Parliamentary inquiry
8. Withdraw a motion

C. Subsidiary

1. Lay on table
2. Previous question
3. Limit or extend debate
4. Postpone definitely
5. Refer to committee
6. Amend
7. Postpone indefinitely

D. Main Motions

1. General Main Motion
2. Specific Main Motion
 - a. Take from table
 - b. Reconsider
 - c. Adopt a resolution
 - d. Adjourn
 - e. Create order of day
 - f. Amend

SHEEP BREEDS

Instructor's Guide

1. There are three parts to this unit (a) Breed Id., (b) Basic Management, (c) Sheep selection. You may choose to use all three or put more emphasis on livestock skills. For instructional information on livestock skills (castrating, docking, etc.) write for a catalog to Texas A & M (address provided below). Livestock skills are planned for the AgII Guide.
2. Have students write to the breed associations to gather information.
3. Have students report their findings orally in class.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds.
6. Use slide sets on breeds of sheep available from either of the following sources:

Vocational Instructional Services
Texas A & M University
F.E. Box 182
College Station, Texas 77843

Vocational Agricultural Service
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801
7. Oregon Sheep Economic Statistics are provided on pages 5,6,7, & 8 of this unit.
8. Make generous use of OSU Extension materials for local adaption.

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed association.
3. Compare advantages and disadvantages of the breeds.
4. Select the breeds most suited to their location.
5. Understand and be able to use terms common to the sheep industry.

6. Identify major breeds of sheep.
7. List the physical traits and production characteristics of major breeds of sheep.
8. Understand basic management concepts for sheep production.
9. Select sheep based on conformation of live animals.

References

1. Gillespie, James R. Modern Livestock & Poultry Production, 1981, Delmar
2. Ensminger, M.E., The Stockman's Handbook, 5th edition, 1978, Interstate
3. Scott, George E., The Sheepman's Production Handbook, 1971, Abegg Printing, Denver, Colorado
4. Texas A & M Student Materials on Sheep Breeds and Sheep Selection.
5. Illinois instructional materials on Sheep Breeds and Sheep Selection.

Teaching Aids

1. Overhead projector with transparencies.
2. Pictures of breeds of sheep.
3. Breed Association publications.
4. Slides of sheep breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of sheep.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Glossary of Terms

Ovine - sheep species

Castration - removal of the testicles, or sex glands, of the male.

Cross bred - an animal whose sire and dam are of different breeds.

Lactation - period female animal gives milk.

Pedigree - a written record of an individual animal's parentage and ancestry.

Bloat - sudden and often fatal distension of the abdomen in animals.

Dressing percentage - weight of the carcass of an animal expressed as a percentage of the living weight.

Gestation period - the period between breeding of the female and birth of the offspring.

In-breeding - the mating of very closely related animals as full brother and sister.

Grade animal - usually applies to any animal which is not pure-bred.

Line-breeding - the mating of animals that are related, but which are not as close as brother and sister.

Mongrel - an animal of nondescript or mixed breeding.

Parturition - the act of giving birth to young; applies to all animals.

Pure-bred - an animal carrying only the blood of some one breed.

Scrotum - the pouch of skin containing the testicles of the male animal.

Buck - male sheep or goat of breeding age.

Ewe - female sheep of breeding age.

Gummy - an old ewe having a badly broken mouth.

Dock - the portion of the tail left after docking.

Lamb - a sheep under 12 months and having no permanent teeth.

Ram - a male sheep of breeding age.

Scurs - a button type growth taking the place of horns.

Wether - a castrated male sheep.

Commercial - a non-purebred animal.

Crossbred - an animal resulting from the mating of two different breeds.

Crossbred breeder - a breeder of livestock producing animals that are of the offspring of animals of two different breeds.

Easter lamb - a lamb that is raised and sold on the Easter market.

Environment - the complex of climatic and biotic factors that act upon an organism to determine its form and survival (example - management, climatic factors, nutrition, etc.).

Ewe - a female sheep.

Exotic breeds - the new European breeds and others which are currently being imported into the U.S..

F₁ females - female sheep from the first cross mating of two different purebreds of sheep.

Fall lamb - a lamb that is usually born in the spring and sold in the fall.

Feeders - animals which have been grown out to a determined size or weight and are ready to be placed in the feedlot for finishing to a determined grade.

Mutton - a sheep or goat over one year of age that was castrated while a lamb.

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

Rank	Commodity	AgI-X-6		
		1980p	1979r	1978
		----- thousand dollars -----		
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,670
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*

TOTAL CROSS FARM SALES	1,742,337	1,494,437	1,253,911
p - Preliminary r - Revised	*Includes nursery crops and turf sod.		

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand dollars														
THE STATE...	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas..	5,683	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,334	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	188,598
Multnomah..	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington..	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Coos.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook..	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,996	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	687	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,009	38,735
Josephine..	56	439	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	398,246
Gilliam....	20,227	199	226	108	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Hood River..	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla...	83,314	6,121	794	19,921	12,237	106	12,167	2,700	137,360	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,892	2,448	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,108
Wallowa....	6,244	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes..	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Hurley....	1,499	4,902	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson..	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,880	682	1,960	36,822	83,619
Lake.....	1,431	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

OREGON
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand dollars								dollars						
THE STATE....	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,494,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	10,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,253
Benton....	3,870	386	6,375	2,055	777	396	1,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas..	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,860	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah..	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,002	1,823	12,443	44,495
Washington.	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop....	---	43	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,886	4,744	6,838
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook..	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,091
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,536	37,380
Josephine..	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	583	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River..	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,630	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	766	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa....	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes..	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,936
Jefferson..	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

Name _____

AGI-X-9

Breeds of Sheep

*Terms: All terms underlined are included in the "Glossary of Terms."

Note: A 2x2 slide set, "Breeds of Sheep and Goats," is available from Vocational Instructional Services, Texas.

I. Importance of Sheep

Sheep and wool production, mentioned in the Bible, is one of our oldest livestock industries. Early humans depended upon sheep for their clothing, meat, tallow, and milk. Fabrics of wool have been unearthed in the ruins of villages inhabited by the Swiss Lake dwellers ten thousand years ago. Sheep were introduced to the American continent by Spanish conquerors; Columbus found room on his ship for sheep on his second voyage to the American continent.

There were two main reasons for the rapid development of the sheep industry in the U.S.. The first was the need for wool for clothing, and the second was the demand for lamb and mutton by the large influx of foreign laborers, who were accustomed to eating lamb and mutton.

II. Kinds of Sheep Breeders

There are two types of sheep breeders, the registered and the commercial. The breeder of registered sheep tries to produce breeding sheep that will be in demand by other breeders of registered sheep and the commercial producer.

The commercial producer can be further divided into two kinds: the farm flock owner and the rancher.

The farm flock owner generally has a small flock of sheep that are grazed on permanent pastures and crop residue. He/she usually produces cross-bred lambs by breeding a medium wool ram on fine wool ewes. The off-spring from this cross have more desirable conformation and fattening qualities than do fine wool lambs, and the flock owner is able to demand a better price for the wool sheared from his/her fine wool ewes than he/she would from cross-bred ewes.

The rancher controls a large area of land, a large number of sheep, and may use one or more systems, or a combination of systems to produce wool and meat. Most ranchers run a ewe-lamb operation. With this system the rancher tries to produce lambs and wool from the ewes. He/she sells the ewe or wether lambs as Easter lambs, fall lambs, spring lambs, old-crop lambs, or as feeders. Depending on several factors,

the method chosen will vary from year to year.

III. How Sheep Are Classified

Breeds of sheep may be classified on several different factors, including (1) their suitability for mutton or wool production, (2) white face or black face, (3) horned or polled, (4) type of wool produced, and (5) area in which they originate.

The most common classification of sheep is based on types of wool. Table 1 below presents these classes and the common breeds of sheep for each wool type.

TABLE 1: CLASSES AND COMMON BREEDS OF SHEEP

Fine-wool Type	Medium-wool Type	Long-wool Type	Cross-bred Type	Fur-wool Type
American Merino	Cheviot	Cotswold	Columbia	Karakul
Delaine Merino	Dorset	Leicester	Corriedale	
Merino	Hampshire	Lincoln	Targhee	
Rambouillet	Oxford	Romney		
Dubouillet	Shropshire			
	Southdown			
	Suffolk			

Since there are over 200 breeds of sheep, this topic will contain only the more popular breeds.

IV. Breeds of Sheep

BREEDS	ORIGIN	CHARACTERISTICS
A. Fine-wool breeds		
1. American Merino, Delaine Merino, or Merino	A. Originated in Spain. The name Merino came from the early day royal office of Spain, called Merino. B. All three breeds were developed from the Spanish Merino, which was imported to the U.S. from Spain in 1973. C. The name used depends on type. American Merino has wrinkles and skin folds. The Delaine Merino has smooth skin.	(1) Wool..... (a) Fine spinning count 64's-80's (b) Staple length-2½-4" (c) Fleece weight-6-14 lbs. (d) Shrinkage-45-60% (2) Rams either horned or polled. Ewes are polled. Head and legs covered with wool. (3) Size..... (a) Rams: 150-200 lbs. (b) Ewes: 110-150 lbs. (4) Color..... (a) White face and legs (b) Pink skin (c) Reddish lips and nostrils (5) Production..... (a) Good grazers (b) High producers of wool both in quantity and quality. (c) Slow growers (d) Good suckling qualities (e) Long productive life (f) Extremely hardy
2. Debouillet	A. A.D. Jones, Roswell, New Mexico B. Developed by crossing Delaine Merino rams to Rambouillet ewes C. Developed under practical range conditions	(1) Wool..... (a) Fine, spinning count, 60's-70's (b) Staple length-2½-3½ in. (c) Fleece weight-8-16lbs. (d) Shrinkage-55-70% (2) Rams are horned or polled. Ewes are polled. Open faced characteristic. (3) Size..... (a) Rams: 150-250 lbs. (b) Ewes: 125-170 lbs.

BREEDS

ORIGIN

CHARACTERISTICS

Debouillet (Continued)

- (4) Color..... (a) White face and legs
 (b) Flesh colored lips and nostrils
 (c) Black spots not uncommon
- (5) Production..... (a) They do an acceptable job of wool and mutton production under adverse conditions.
 (b) Production is fairly uniform in grade of wool.

3. Rambouillet

A. Rambouillet, France

B. Developed from the Spanish Merino

C. First introduced into the U.S. in 1840

- (1) Wool.....(a) Fine, spinning count, 62's-80's
 (b) Staple length-2½-4"
 (c) Fleece weight-7-14 lbs.
 (d) Shrinkage-45-65%
- (2) Rams are horned or polled. Ewes are polled. Large, wide head mostly covered with wool.
- (3) Size.....Largest of the fine-wool breeds
 (a) Rams: 190-300 lbs.
 (b) Ewes: 120-210 lbs.
- (4) Color.....(a) White face and legs
 (b) Flesh colored lips and nostrils
- (5) Production.....(a) Good mothers, prolific
 (b) Very good range qualities
 (c) Tendency for face covering of wool
 (d) Reasonably good meat qualities

BREEDS

ORIGIN

CHARACTERISTICS

Rambouillet (Continued)

(e) Production is very acceptable in quantity and quality of wool.

B. Medium Wool, Mutton or Meat Breeds

1. Cheviot

A. Cheviot Hills between England and Scotland

B. First imported to U.S. in 1838.

(1) Wool.....(a) Medium, spinning count, 48's-56's
(b) Staple length-3-4"
(c) Fleece weight-5-8 lbs.
(d) Shrinkage 25-50%

(2) Rams and ewes are polled. No wool is on the head and face, nor below the knees and hooks.

(3) Size.....One of the smaller breeds
(a) Rams: 150-200 lbs.
(b) Ewes: 90-165 lbs.

(4) Color.....(a) White face
(b) Black nostrils, lips, and feet
(c) Black spots on legs, ears, and face not uncommon

(5) Production.....(a) Good mothers
(b) Small at birth
(c) Slow growers, but hardy
(d) Slow to fatten
(e) Good grazers on rough pastures
(f) Average about 125% lamb crop

(6) A very attractive breed with head carried high, erect ears, and a quick coordinated stride

BREEDS

ORIGIN

CHARACTERISTICS

2. Dorset

A. Dorset and Somerset
Counties, England

B. First importation
to the U.S. was made
in 1885.

- (1) Wool.....(a) Medium, spinning count
36's-56's
(b) Staple length-2½-4"
(c) Fleece weight-4-10 lbs.
(d) Shrinkage-25-50%
- (2) A unique feature is that there are both
horned and polled strains. Within the horn-
ed strain, ewes are horned. Face and ears
are practically free from wool.
- (3) Size.....Medium-sized breed
(a) Rams: 150-225 lbs.
(b) Ewes: 120-190 lbs.
- (4) Color.....(a) White face, ears, and
legs
(b) Pink nostrils, lips,
and skin
(c) White hooves
- (5) Production.....(a) Heavy milkers
(b) Fast growers
(c) Average carcass quality
(d) Poor grazers
(e) Fair feeders
(f) Ewes will breed out of
season
(g) Average nearly a 150%
lamb crop
(h) One of the lighter
shearing breeds

3. Hampshire

A. Hampshire
County, England

B. Several importations
were made to the U.S.
prior to 1860

- (1) Wool.....(a) Medium, spinning count
46's-60's
(b) Staple length-2-2½"
(c) Fleece weight-4-10 lbs
(d) Shrinkage-38-50%
(e) Fleece is of medium
quality.

BREEDS

ORIGIN

CHARACTERISTICS

Hampshire (Continued)

(2) Rams and ewes are polled. Bald head and prominent ears are distinctive.

(3) Size.....Among the largest of medium wool breeds
(a) Rams: 170-275 lbs.
(b) Ewes: 135-215 lbs.

(4) Color.....(a) Dark brown or black face, ears, and legs

(5) Production...(a) Very desirable carcasses
(b) Rapid growers and aggressive feeding habits
(c) Heavy milkers
(d) Long, deep bodied
(e) Heads criticized for being large, long, and having Roman nose
(f) Used extensively in crossbreeding with excellent results

4. Oxford

A. Oxford County, England

B. First introduced to the U.S. in 1846

C. Resulted from crossing Cotswold and Hampshires

(1) Wool.....(a) Medium, spinning count 46's-50's
(b) Staple length-3-5"
(c) Fleece weight-8-12 lbs.
(d) Shrinkage-38-50%

(2) Rams and ewes are polled. Easily distinguished from other breeds by top knot of wool over the head

(3) Size.....Largest of the medium-wool breeds
(a) Rams: 200-275 lbs.
(b) Ewes: 150-225 lbs.

BREEDS

ORIGIN

CHARACTERISTICS

Oxford (Continued)

- (5) Production.....(a) Prolific and good milkers
 (b) Large and vigorous at birth
 (c) Rapid growers
 (d) Slow finishers
 (e) Lambing percentages of 150% are not uncommon
 (f) Heaviest fleece of any of the Down breeds

5. Shropshire

A. Shropshire and Stafford Counties, England

B. First importation was made into Virginia in 1855.

C. Developed from several breeds including the Southdown, the Leicester, and the Cotswold

- (1) Wool.....(a) Medium, spinning count 48's-60's
 (b) Staple length-2½-3"
 (c) Fleece weight-5-10 lbs.
 (d) Shrinkage-25-50%
- (2) Rams and ewes are polled. Dense wool covers the poll, face, and legs.
- (3) Size.....(a) Rams: 150-225 lbs.
 (b) Ewes: 120-170 lbs.
- (4) Color.....(a) Deep brown colored face, ears, and legs
 (b) Black hooves

C. Long Wool Breeds

1. Cotswold

A. Gloucestershire, England

B. First imported to U.S. in 1832

- (1) Wool.....(a) Coarse, spinning count 36's-40's
 (b) Staple length-8-14"
 (c) Fleece weight-10-15 lbs
 (d) Shrinkage-20-35%
 (e) Fleece carried in rather bold locks.

BREEDS

ORIGIN

CHARACTERISTICS

Cotswold (Continued)

- (2) Rams and ewes are polled. Most distinguishing characteristic is foretop of wool hanging from forehead down to the eyes.
- (3) Size.....(a) Rams: 250-275 lbs.
(b) Ewes: 175-225 lbs.
- (4) Color.....(a) White face with grayish specks
(b) Black nostrils, lips, and skin about the eyes
(c) White or flecked with white and gray legs
- (5) Production.....(a) Prolific and good milkers
(b) Rapid growers, slow to fatten
(c) Meat coarse-textured
(d) Better grazers than Lincoln
(e) Hardy and active
(f) Demonstrated its greatest usefulness in crossing on commercial herds lacking size
- (6) The breed has never been very popular in the United States.

2. Leicester

A. Leicester County,
EnglandB. First brought to
the U.S. prior to
the Revolutionary War

- (1) Wool.....(a) Coarse, spinning count 40's-48's
(b) Staple length-6-8"
(c) Fleece weight-9-12 lbs.
(d) Shrinkage-20-35%

BREED

ORIGIN

CHARACTERISTICS

Leicester (Continued)

- (2) Rams and ewes are polled. Face and legs are free of wool.
- (3) Size.....Medium in size
 (a) Rams: 225-250 lbs.
 (b) Ewes: 175-200 lbs.
- (4) Color.....(a) White face
 (b) Black lips and nostrils, black spots on face and other parts
- (5) Production.(a) Not adapted to sheep raising requirements
 (b) Ewes are good milkers but are not very prolific
 (c) Do not finish at proper weight
 (d) Large amounts of external fat
 (e) Not adapted to severe weather
 (f) Used primarily for crossing purposes in the U.S.

3. Lincoln

A. Lincolnshire, England

B. First imported to U.S. about the close of eighteenth century

- (1) Wool.....(a) Coarse, spinning count 36's-46's
 (b) Staple length-18-14"
 (c) Fleece weight-12-20 lbs
 (d) Shrinkage-20-30%
- (2) Rams and ewes are polled. Large head and ears and pronounced forelock are characteristic.
- (3) Size.....Referred to as the largest breed of sheep

BREEDS

ORIGIN

CHARACTERISTICS

Lincoln (Continued)

(a) Rams: 250-350 lbs.

(b) Ewes: 175-250 lbs.

- (4) Color.....(a) White face
 (b) Dark lips, nostrils, and legs
 (c) Spots occur on ears and legs and occasionally on the face

- (5) Production.....(a) Prolific and good milkers
 (b) Rapid growers
 (c) Fatten at heavyweight
 (d) Large amount of external fat
 (e) A very rugged and heavy breed of sheep
 (f) Produce the heaviest and coarsest fleece of long-wool breeds

4. Romney

A. Kent County, England

B. First introduced into U.S. in 1904

- (1) Wool.....(a) Coarse, spinning count 44's-50's
 (b) Staple length-5-6"
 (c) Fleece weight-10-12 lbs
 (d) Shrinkage-20-35%
 (e) Fleece has more compactness and crimp than other breeds

- (2) Rams and ewes are polled. Distinguished by a foretop of wool between the eyes and wool on the jaw.

- (3) Size.....Medium sized breed
 (a) Rams: 225-250 lbs.
 (b) Ewes: 120-200 lbs.

BREEDS

ORIGIN

CHARACTERISTICS

Romney (Continued)

- (4) Color.....(a) White face and legs
(b) Dark nostrils, hooves, and legs
- (5) Production.....(a) Very hardy
(b) Good grazers
(c) Carcass quality is more acceptable than other long-wool breeds
(d) Suckle well
(e) Finish easier than other long-wool breeds
(f) Ewes cross well with rams of other breeds

D. Crossbred-Wool Breeds

1. Columbia

A. King Ranch,
Laramie, Wyoming

B. First breed of sheep developed in the United States; Lincoln rams were crossed on Rambouillet ewes.

C. The breed was officially started by the Bureau of Animal Industry in 1917

- (1) Wool.....(a) 3/8 blood wool, spinning count 50's-58's
(b) Staple length-3½-5"
(c) Fleece weight-10-18 lbs.
(d) Shrinkage-45-55%
- (2) Rams and ewes are polled. Identified by an open face covered with white hair.
- (3) Size.....Largest of the crossbred-wool breeds
(a) Rams: 75-300 lbs.
(b) Ewes: 130-225 lbs.
- (4) Color.....(a) Face white and free of wool
(b) Occasional black spots on face and ears
(c) White hooves and legs
- (5) Production.....(a) Prolific and good milkers

BREEDS

ORIGIN

CHARACTERISTICS

Columbia (Continued)

- (b) Fair carcass quality
- (c) Rapid growers
- (d) Fattening quality is fair
- (e) Lambs are of good conformation and feeding quality

(6) Well suited to western range conditions

2. Corriedale

A. New Zealand

- (1) Wool.....(a) 3/8 blood, spinning count 50's-60's
- (b) Staple length-3½-6"
- (c) Fleece weight-8-17 lbs.
- (d) Shrinkage-40-50%
- (e) Fleece is of excellent quality

B. The breed was developed by crossing Lincoln and Leicester rams on Merino ewes.

C. First brought to the U.S. in 1914 by the National Wool Growers' Association

- (2) Rams and ewes are polled. Open face is characteristic.
- (3) Size.....(a) Rams: 150-250 lbs.
- (b) Ewes: 105-205 lbs.
- (4) Color.....(a) White face, ears, and legs
- (b) Occasional black spots on face and ears
- (5) Production.....(a) Outstanding producers, producing more lambs and pounds of wool per body weight than other range breeds
- (b) Early maturing
- (c) Good mutton conformation

BREEDS

ORIGIN

CHARACTERISTICS

Karakul (Continued)

- (a) Rams: 175-225 lbs.
 - (b) Ewes: 135-160 lbs.
 - (4) Color.....
 - (a) Brown or black
 - (b) Black head, mouth, nostrils, feet, and legs
 - (5) Production.....
 - (a) Body narrow and uneven
 - (b) Legs lack fullness
 - (c) Ewes are good milkers
 - (d) Lambs discounted on market
 - (e) Ewes not prolific
 - (f) A hardy breed under adverse conditions
-

BREED REGISTRY ADDRESSES

Fine-wool Breeds

American and Delaine Merino Record Association
Aleppo, PA 15130

Debouillet Sheep Breeders' Association
Roswell, NM 88201

American Rambouillet Sheep Breeders' Association
2709 Sherwood Way
San Angelo, TX 76901

Long-wool Breeds

American Cotswold Record Association
Sigel, IL 62462

Leicester
(No breed registry in U.S.)

National Lincoln Sheep Breeders' Association
Route 1
West Milton, OH 45383

American Romney Breeders' Association
4375 NE Weslinn Dr.
Corvallis, OR 97330

Fur-wool Breed

Karakul Fur Sheep Registry
Ted Stulz, Secretary
Fabius, NY 13063

Medium-wool Breeds

American Cheviot Sheep Society
c/o Henry Kuy Kendall
RR 2
Lebaron, VA 24266

Breed Registry Addresses
(Continued)

Continental Dorset Club
P.O. Box 577
Hudson, LA 50643

American Hampshire Sheep Association
c/o Jim Cretcher
RR 10
P.O. Box 199
Columbia, MO 65201

American Oxford Down Record Association
Eaton Rapids, MI 48827

American Shropshire Registry Association
P.O. Box 1970
Monticello, IL 61856

American Southdown Breeders' Association
c/o Florence Stronse
RR 4, Box 14B
Belleville, PA 16823

American Suffolk Sheep Society
c/o VE Neal Jenkins
55 E., 100 N.
Logan, UT 84321

National Suffolk Sheep Association
P.O. Box 324
Columbia, MO 65201

Crossbred-wool Breeds

Columbia Sheep Breeders' Association of American
P.O. Box 272
Upper Sandusky, OH 43351

American Corriedale Association
P.O. Box 29C
Seneca, IL 61360

U.S. Targhee Sheep Association
c/o Wayne Thaler
726 Terry Ave.
Billings, MT 59102

SELECTED STUDENT ACTIVITIES

1. List the names of the sheep breeds which were developed in the United States.
 - a.
 - b.
 - c.
 - d.
2. List the different factors on which breeds of sheep may be classified.
 - a.
 - b.
 - c.
 - c.
 - e.
3. What two factors seem to have been responsible for the decrease in sheep numbers in the United States?
 - a.
 - b.
4. What is the dollar value of the sheep industry to Oregon and to your county?
5. Define the term "prolific," which is often used in describing breeding ewes.
6. Which of the wool-types is most commonly found in the area in which you live?
7. Select the sheep breed of your choice and write the breed registry association for additional information and pictures.
8. What are the values for which dual-purpose breeds of sheep are noted?
 - a.
 - b.
9. Write the name of the sheep breed in the space that is provided for each description given below.

_____ Developed under practical range conditions
by crossing Delaine Merino rams to
Rambouillet ewes

_____ Largest in size of the fine-wool breeds;
rams are generally horned and ewes are
polled

Some sheep of this breed have wrinkles or skin folds while others have smooth bodies.

Easily identified by its black face, legs, and ears which are entirely free from wool.

Smallest in size of the medium-wool breeds; surpasses other breeds in carcass conformation.

Considered a good dual-purpose breed; developed from a blending of the South-down, Leicester, and Cotswold breeds.

Largest in size of the medium-wool breeds; the result of crossing Cotswolds and Hampshires; easily distinguished by a top knot of wool over the head.

Distinctive in appearance with the face, head, and legs below the knees and and hocks being free from wool and covered with white hair.

One of the most popular breeds in the U.S. today; identified by a rich deep brown color on the face, ears, and legs.

Both horned and polled strains are found in the breed, and ewes are also horned within the horned strain.

A breed of the long-wool type identified by white face, ears, and legs, with a foretop of wool extending down between the eyes and over the jaw.

Referred to as the largest breed of sheep, producing the heaviest and coarsest fleeces.

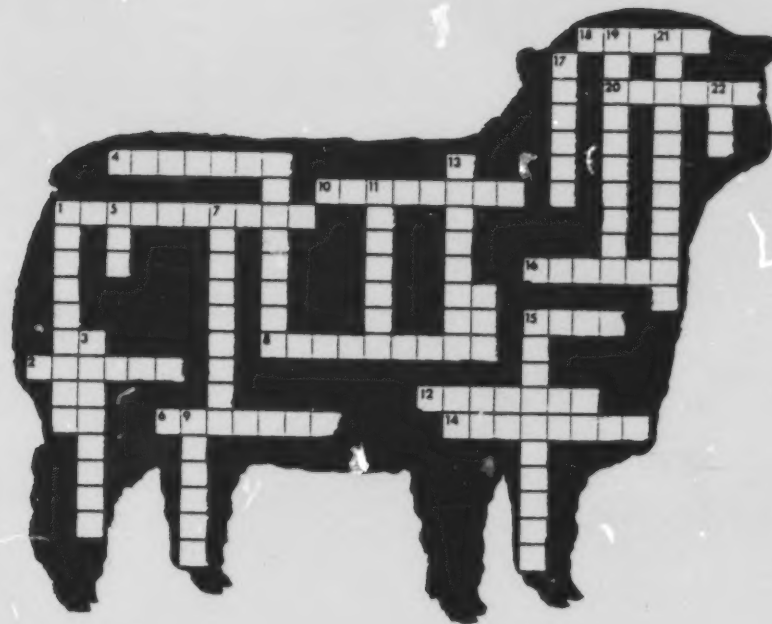
A long-wool breed that has demonstrated its greatest usefulness in crossing on commercial herds lacking size, fleshing qualities, and length of fleece; lacks popularity in the U.S.

A breed originated in the U.S. from a combination of Rambouillet, Corriedale, and Lincoln breeding, with an emphasis on its utility value on western ranges.

Largest of the crossbred-wool breeds; developed in the U.S. by crossing Lincoln rams on Rambouillet ewes.

_____ First brought to the U.S. by the
National Wool Growers' Association
in 1914, being recognized as a good
producer of both wool and mutton.

_____ A fur-bearing breed of sheep native
to the U.S.S.R.



10. Cross Word Puzzle

ACROSS

1. Imported to Virginia in 1855 from Shropshire and Stafford Counties in England
2. Imported to the U.S. in 1885 from Dorset and Somerset Counties
4. Originated in England from crossing Southdown rams and Old Norfolk ewes
6. One of the smaller breeds of medium-wool sheep imported from the border county between England and Scotland
8. A long-wool breed originating in Central England and possessing fleece of high quality which is carried on fine spiral locks
10. A long-wool breed characterized by the way the foretop hangs from the forehead to the eyes
12. A very rugged and heavily fleshed breed of sheep first imported to the U.S. about the close of the eighteenth century
14. The first breed of sheep developed in the U.S., with first crosses being made in Wyoming
16. The _____ clip refers to the amount of wool sheared from the bodies of sheep.
18. Small, loosely attached horns that sometimes appear on polled animals
20. A long-wool breed originating in the marsh area of Kent County, England
22. The female sheep

395

DOWN

1. A small breed of sheep originating in Sussex

Cross Word Puzzle (Continued)

DOWN

- County, England, and noted for its excellence of carcass conformation
3. Abundant reproduction
 5. The male sheep
 7. A sheep possessing most of the qualities desired in mutton sheep and a very popular breed in the U.S.
 9. A distinguishing head characteristic of most rams of Merino breeding
 11. A breed of sheep developed at the U.S. Sheep Experiment Station in Idaho
 13. _____ lambs are born in fall or early winter and finished for market at about 30 to 60 pounds.
 15. Breeds of sheep that were developed in the downs or range of hills in southern England are collectively referred to as the "_____" breeds.
 17. This breed produces the heaviest fleece of any of the Down breeds.
 19. A breed of crossbred-wool type developed in New Zealand
 21. A breed of sheep developed in France and a descendant of the Spanish Merino

SHEEP MANAGEMENT INFORMATION

Instructor's Guide

The following information is needed by freshman students as a basis to begin their sheep projects. This information should be made available to all students to aid them with their projects. It is not a complete management unit; however, it does represent important basic facts and rules of thumb.

THUMB RULES FOR SHEEP

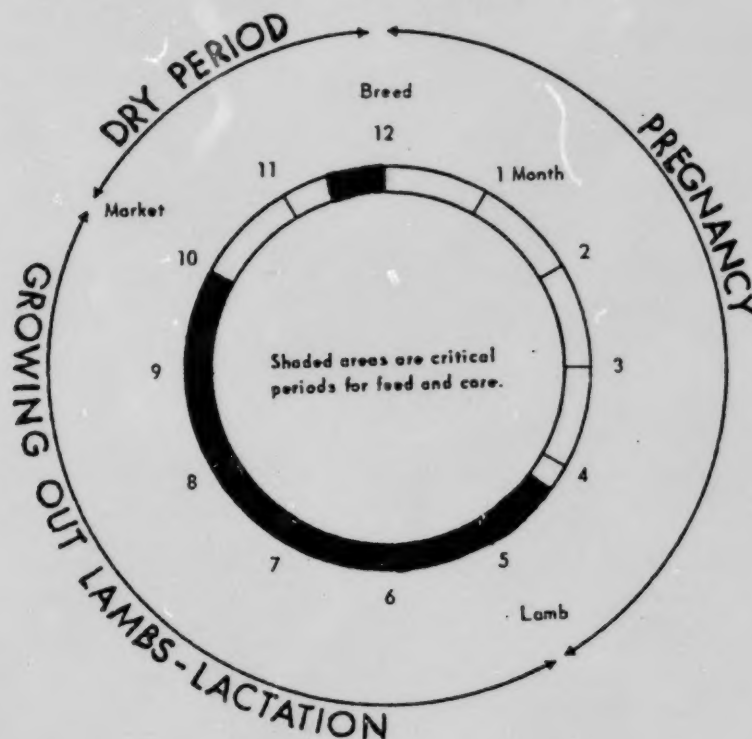
1. Ewe lambs that weigh at least 90 pounds when 7 months of age should be bred to lamb at 1 year of age.
2. Gestation period for ewes is 150 days or 5 months.
3. Length of heat period is 14-19 days (ave. 17 days) for ewes. Most ewes don't exhibit heat from March through July.
4. Lamb prices are generally highest in the Spring and lowest in the Fall.
5. A 70 pound lamb will consume 1 to 2 lbs. of grain and $1\frac{1}{2}$ lbs. of hay during the fattening period per day.
6. Ewes should receive 1 to $1\frac{1}{2}$ lbs. of grain per day for 14 days after lambing along with all the good quality forage they can eat.
7. Ewes should receive $3\frac{1}{2}$ to 4 lbs. of good quality alfalfa hay and $\frac{1}{4}$ lb. of grain per day 6 weeks before lambing.
8. Castrate and dock within 2 weeks of birth.
9. Drench ewes for internal parasites at least 3 times per year.
10. Vaccinate ewes and lambs with BoSe or MuSe to prevent white muscle disease.
11. Vaccinate all lambs for enterotoxemia prior to 1 month of age.
12. 5 - 7 ewes and their market weight lambs can generally be fed on the same amount of forage as a cow and her weanling calf.
13. Lambs are generally marketed at weights of 90 to 110 pounds.
14. Phenothiazine mixed with salt (1 Pheno: 10 salt) and fed free-choice will help control internal parasites between drenchings.
15. Dressing percents for lambs is approximately 50%.

CARE OF THE GESTATING EWE IN WESTERN OREGON

Prepared by: Dr. David L. Thomas,
Extension Animal Scientist and
Dr. Thomas E. Bedell,
Extension Rangeland Resources Specialist
Oregon State University,
Corvallis, Oregon

During the five month period from conception to lambing, little attention is generally given the ewe. This is as it should be because during the majority of this period the ewe is "working" very little relative to most other periods of the year. This period of minimum care during the majority of pregnancy is schematically represented below in figure 1.

Figure 1. THE SHEEP PRODUCTION YEAR



However, we must remember that minimum care still means some care. At conception, the maximum number of lambs that the ewe will deliver has been determined. In order that a high proportion of these future lambs are actually born and are alive and vigorous at birth, the ewe needs to be treated properly during pregnancy. 389

The following discussion is based on a late winter-early spring lambing program in Western Oregon with ewes that

weigh 140 pounds at breeding. The mating season is initiated on September 1 with lambing beginning on January 26. The predominant type of pasture available is subclover-grass. Grasses are predominantly perennial ryegrass or tall fescue and orchardgrass.

NUTRITION

Early Gestation

From the time of conception through the first 15 weeks of gestation the ewe requires only enough nutrients to slightly exceed the amount required to maintain her body weight. These additional nutrients over maintenance are needed for the relatively slow developing fetus. During this 15 week period, 1.7 pounds at TDN (total digestible nutrients) and .27 pounds of crude protein are required per ewe per day.

If the average conception date of the ewes in the flock is September 15, the 15 week period of early gestation ends about the end of December (December 29). During this period, 3½ pounds of dry matter per day from a subclover-grass pasture will meet the ewe's requirements. Under most grazing situations, there is enough pasture forage available for the ewe to meet these requirements until approximately December 1. Some of the forage available is left from the spring and early summer growing season and some is new growth brought on by the early fall rains. However, under most situations, by December 1, the old forage has been consumed and the new pasture growth is not rapid enough to meet the ewe's needs. Therefore, during this last month of early gestation one should have an available source of additional nutrients. An excellent and generally economical source is hay produced from the subclover-grass pasture the previous June when far more forage was available in the pasture than the ewes could consume. Four pounds of this hay per ewe per day will meet the ewe's requirements if we estimate the hay to be 90% dry matter, 50% TDN and 8% crude protein. If hay is not available, any cheap feed source that will provide the ewe's nutrient needs would be acceptable.

It is obvious that the date of December 1 is not a sacred date on which hand feeding is to begin. If there is a considerable amount of forage standing in the pasture and if the fall rains have been exceptionally good, it's possible that no hand feeding need be done through the end of December. On the other hand, if the pasture is extremely short at the start of the breeding season and the fall rains are poor, hand feeding of hay will have to start well in advance of December 1. As a check on your feeding, ewes are recommended to gain about ½ pound per week during early gestation for a total weight gain of 7.5 to 8 pounds over the entire 15 week period.

Late Gestation

Since approximately 70 percent of fetal growth occurs during the last 6 weeks of gestation, the late gestation period from the first of January to the average lambing date of approximately February 15 becomes critical in ewe nutrition. During this period, the ewe needs increased amounts of nutrients not only for fetal growth but also to assure adequate future milk production. During this period, the ewe's TDN requirement increases by 41% (to 2.4 pounds per ewe per day), and her crude protein requirement increases by 33% (to .36 pounds per ewe per day) from the 15 week period of early gestation.

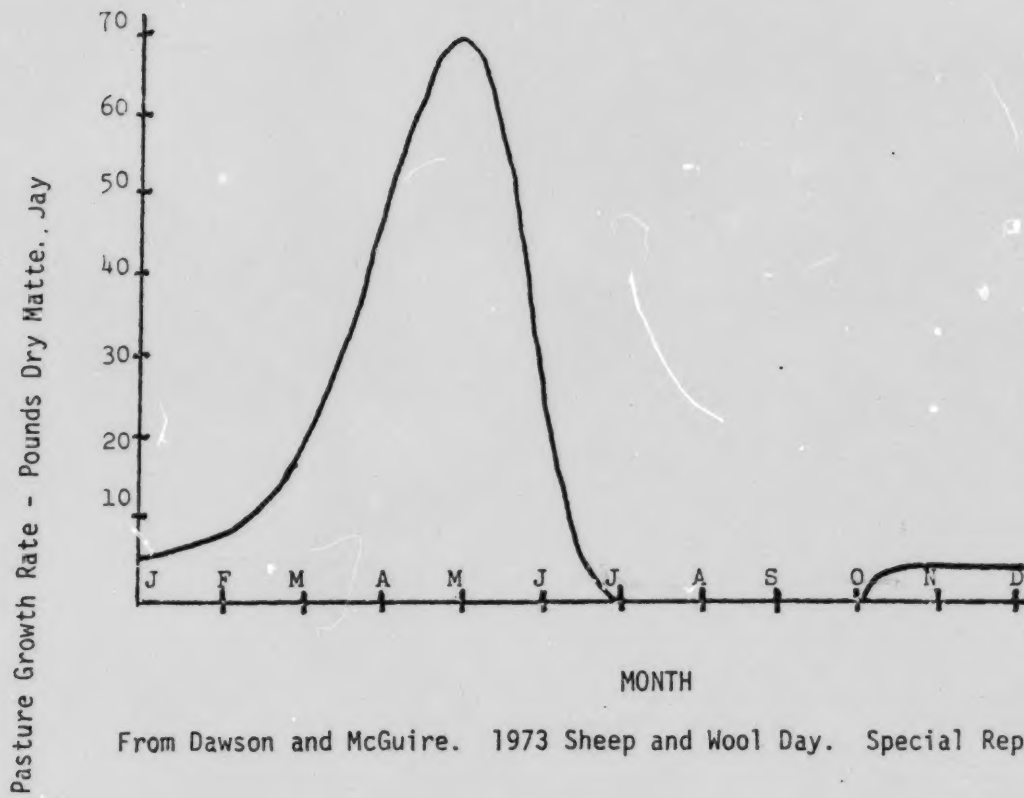
Internal Parasites

In order to reduce stress on the late gestating and lactating ewe and in order to minimize exposure of the lamb, ewes should be drenched for internal parasites 2 to 4 weeks prior to lambing. A number of products are available. Research at several institutions has indicated that thiabendazole is one of the most ineffective chemicals.

Foot Care

All lame sheep must be examined and cases of foot rot treated immediately. The hooves need to be trimmed down to good tissue and all sheep run through a foot bath of 10% formalin solution produced by adding 2 gallons of formalin to 18 gallons of water. More specifics can be found in USDA Farmer's Bulletin No. 2206 obtainable from your extension agent.

Figure 2. GROWTH CURVE FOR SUBLOVER-GRASS PASTURE



From Dawson and McGuire. 1973 Sheep and Wool Day. Special Report 382. O.S.U.

Selecting Sheep

*Terms: All terms underlined are in the "Glossary of Terms."

I. Selecting Sheep Types

Before going into the sheep business, prospective producers should be sure that they like sheep, that they understand their peculiarities, and that the farm or ranch is adapted to sheep production.

Since there are several types of sheep, several methods of production, and since sheep are a multiproduct animal, producing wool, meat, and pelts for furs, prospective producers should determine the production methods they are going to follow before selecting the individual animals. There are two kinds of sheep producers in Oregon: the farm flock producer and the rancher. Several systems of production are used by both kinds of producers.

Because of their herding instinct, fine wool sheep are better adapted to the open range; therefore, they should be selected for range production. Mutton breeds or medium wool breeds tend to do better under farm flock conditions, so these breeds, or a cross of the medium wool and the fine wool breeds, should be selected for farm flock production.

II. Criteria for Selecting Sheep

The criteria used for selecting sheep will vary according to the use for which the animal is intended. Generally sheep are selected for the following purposes: (1) breeding sheep, with mutton production as the primary objective; (2) breeding sheep, with wool production as the primary objective; (3) feeder lambs for the feedlot; or (4) slaughter lambs for the market (including show lambs).

Thus, when mutton production is the primary objective, attention is given to producing heavy weaning lambs of acceptable grade and type. When sheep are selected for wool production, the clean weight and quality of fleece are of primary importance. Selection of feeder lambs is based on desirable type and quality, health and vigor, and predicted performance in the feedlot. Slaughter lambs are selected for the market using conformation, finish, and estimated quality and yield of carcass as the criteria in determining value.

Selecting sheep requires a trained hand as well as a trained eye. Since sheep have a covering of wool on their bodies most of the time, the buyer must feel of the animal to accurately determine its

conformation. After the buyer has gained experience in selecting sheep in-the-wool, he/she will experience little difficulty in determining conformation.

Because the fine wool producer receives a part of his/her income from the sale of lambs and the medium wool producer receives a part of his/her income from the sale of wool, selection--regardless of breed and method of production--should be based on (1) conformation and wool, (2) production records, (3) pedigree, and (4) health and vigor. However, a producer is seldom able to base his/her selection on all of the above factors.

A. Selection Based on Conformation

The selection or judging of sheep differs from other forms of livestock because two products of economic importance are involved instead of one. In some instances, both meat and wool must be given consideration. While one must use both the eye and the hand to judge, a general idea of the conformation may be gained by sight alone.

1. Body Conformation

If the student has developed a mental picture of the ideal conformation of a beef animal, it should be rather easy for him/her to develop a mental picture of the ideal conformation of a sheep, as the conformation of both is similar.

Transparency No. 1

The first step in preparation for selecting or judging sheep is to become familiar with the language that describes or locates the parts of a sheep.

Transparency No. 2

In order to relate desirable conformation to the finished market product, it would also be helpful to be familiar with the wholesale cuts of lambs.

Transparency No. 3

The second step in selecting according to conformation, regardless if they are commercial or purebred, is to have an ideal or standard in mind and then select accordingly.

As in selecting other livestock, the procedure for judging sheep according to conformation is to survey the animal at a distance of about 20 feet from the front view, side view, rear view, and then handle the animal in the contact step.

a. Front view

From the front view, the animal should be free of excess skin and finish in the throat and chest area. The chest should be wide and clean and set back into the body to give the animal constitution and capacity as well as the clean, trim, muscular look desired in the modern day "meat type" lamb. The head should be reasonable refined and should possess some quality and character. The front legs should set out wide on the corners of the body and should indicate above average substance of bone. A coarse head and excessively wide, heavy front are undesirable. However, a narrow chest with the front legs close together indicates a lack of ruggedness and constitution.

b. Side view

From the side view, length and ruggedness of body to go along with the desired size and scale are important in yielding carcasses with the largest proportion of the weight in the leg, loin, and rack regions. Extremely short-bodied, compact animals or extremely shallow-bodied animals are undesirable. Extra length of rib, loin, and especially extra length of rump are particularly important in contributing to a larger leg and more weight in the hind saddle.

The animal should be strong-topped, neat and clean in the fore and rear flanks, and trim and tight through the chest region and along the underline. The length of leg should be in proportion to age, growthiness, and stage of maturity. The feet and legs should be placed squarely on all four corners of the animal's body, and the animal should stand on adequate substance of bone for their size and structure.

c. Rear view

The animal should be extremely long in the rump and full and level out over the dock. This extreme thickness should carry down into a deep, thick, full, firm, muscular leg. The rear legs should set wide apart to permit the presence of the muscle volume desired in "meat type" lambs. A close stance on the rear legs and a narrow,

pinched rump contribute to a lack of balance and less weight in the hind saddle.

d. Condition and handling

In the contact step, as one approaches the animal to be examined, the topview should reveal a "coke bottle" shape-- a reasonable slim, clean neck that blends neatly into the shoulders, with a slight prominence at the shoulders which is due to a muscular shoulder, arm, and forearm. The animal should be slightly tight and free from excess fat in the heart area and should have more spread and spring to the rear rib than the fore rib, carrying this extra spread and thickness back into the loin.

A long, level topline, a trim, tight middle, and a definite degree of cleanliness and firmness in the rear flank and crotch regions add to the attractiveness and style of the lamb. A heavy, wasty middle tends to allow more excessive fill and thus reduces yield of the carcass and dressing percentage.

By observing and handling the animal, one can determine rather quickly whether it is extremely fat or thin. Parts of the sheep handled are over the backbone and ribs; along the edge of the rack, back, and loin; and over the hips and across the dock. The hardness or firmness of the animal over the back and loin is also used for determining condition, particularly in grading, to distinguish between an average lamb and a top quality market lamb. In handling over the spinal column or ribs, the fingers should be extended together rather than spread so that one does not get a separate "feel" from each finger. Also, the fingers should be pressed firmly (through the fleece if not shorn) to the flesh or bone. Digging in with the points of the fingers back and forth is a poor technique that is not only a waste of effort and time but also hard on the sheep.

By pressing the hands against the animal's body over the rack, back, and loin, one can also determine the desirability of the width and muscling in these areas.

2. Wool

The degree of emphasis placed on wool by the producer varies with the type of sheep being selected. The general rule in determining the value of wool, using 100% for a total of all factors, is as follows:

5% to 15% for medium wool breeds
25% for long wool breeds
30% for crossbred wool breeds
40% to 60% for fine wool breeds

Transparency No. 4

The major factors considered in the evaluation and classification of wool are: fineness, staple length, density, and clean wool yield.

Fineness or diameter of fiber is the primary factor on which commercial grades of wool are based. Fleeces classified under the U.S. system with regard to fiber diameter are referred to from finest to coarsest as: Fine, $\frac{1}{2}$ Blood, $\frac{3}{8}$ Blood, $\frac{1}{4}$ Blood, Common, and Braid. The word "blood" is a wool-grade term once associated with the breeding of sheep; however, today this is no longer true. The British system, or Spinning Count, is a numerical rating plan based on the amount of yarn that can be spun from one pound of clean wool. This system provides a more precise designation for diameter of fiber and is used almost entirely by mill buyers. The spin count values that correspond to the various blood grades are shown in Table 1.

TABLE 1

PHYSICAL FACTORS AND STANDARDS AFFECTING WOOL VALUE

U.S. Blood	Spinning Count	Staple Length in Inches	Crimps per Inch in the Staple	Shrink
Fine	64's, 70's and 80's	over 2 3/4	14-22	56-61
1/2 Blood	60's and 62's	over 3	10-14	53-59
3/8 Blood	56's and 58's	over 3 1/4	8-10	47-53
1/4 Blood	50's and 54's	over 3 1/2	5- 8	44-50
Low 1/4 Blood	46's and 48's	over 4	2- 5	42-48
Common	44's	-	0- 2	35-40
Braid	36's and 40's	-	0- 1	35-40

Staple length contributes to the quantity of wool and the loftiness of "fleece volume" and is reflected in clean fleece weight. Thus, length of fiber contributes to the value of wool for the producer and is a factor to be considered in selection. Distinct and even crimp is desirable throughout the entire fiber length.

Density refers to the number of fibers grown in a given area of skin. Fleece density is not uniform over the body of a sheep and usually conforms to a pattern--the density being greatest around the line of the spine and decreasing toward the belly. Uniform fleeces require less sorting into different categories and are preferred by woolen mills.

Clean wool yield is the percentage of clean wool remaining after all foreign material has been removed by washing and scouring. Shrinkage and price of wool vary with the content of grease, tags and dung locks, dirt, burrs, straw, etc.

Other factors that affect the general appearance or desirability of wool for processing and contribute to determining the value of the wool include color, character, and wastiness.

Bright, white to cream-colored fleeces are most desirable. Gray or dull-colored fleeces are penalized, particularly if they include excessive amounts of black fibers.

Character traits such as parallel arrangements of fibers and large or "bold" locks of wool improve the general appearance or eye appeal of fleeces and also improve the spinning qualities for manufacturing. Unsoundness and "second cuts" are the principal items contributing to wastiness. Wool fibers should be strong and elastic. Healthy, properly fed sheep usually produce sound wool. "Second cuts" may occur as a result of improper shearing.

In observing the fleece and skin, part the wool well down on the shoulder, side, and leg. Use the back of each hand with the palm held up, and open the part in order to reflect light onto the fleece. Animals showing dark blue skins with paleness in the linings of the nose and eyelids should be regarded with suspicion.

B. Selection Based on Production Records

Possibly because of the limited area in which sheep are produced and the small percentage of farmers and ranchers that produce sheep there has been less production testing of sheep than of other classes of livestock. Even though there has been very little production testing of sheep, production records.

Transparency No. 5

The results of an experiment which involved 75 ranchers with sheep producing wool of similar quality indicated that a selective breeding program provided several benefits. The sheep were more uniform in appearance and wool production. Another improvement noted from selective breeding was the increased percentage of lamb crop. In addition to increasing the percentage of lamb crop, the animals became better suited to the range conditions under which they were being produced.

Transparency No. 6

Production Record Forms

Commercial Flock Record

Individual Record for Rams

Individual Record for Registered Sheep

C. Selection Based on Pedigree

Not as much importance is placed on the pedigree as a basis of selection of sheep as there is in other classes of livestock. Instead of using family names, as is done by many breed associations of other classes of livestock, many sheep breed associations use numbers to designate the registered animal. When the pedigree is used as a basis of selection, the ancestry "close up" in the pedigree should be observed. An outstanding ancestor in the pedigree would be a factor for consideration.

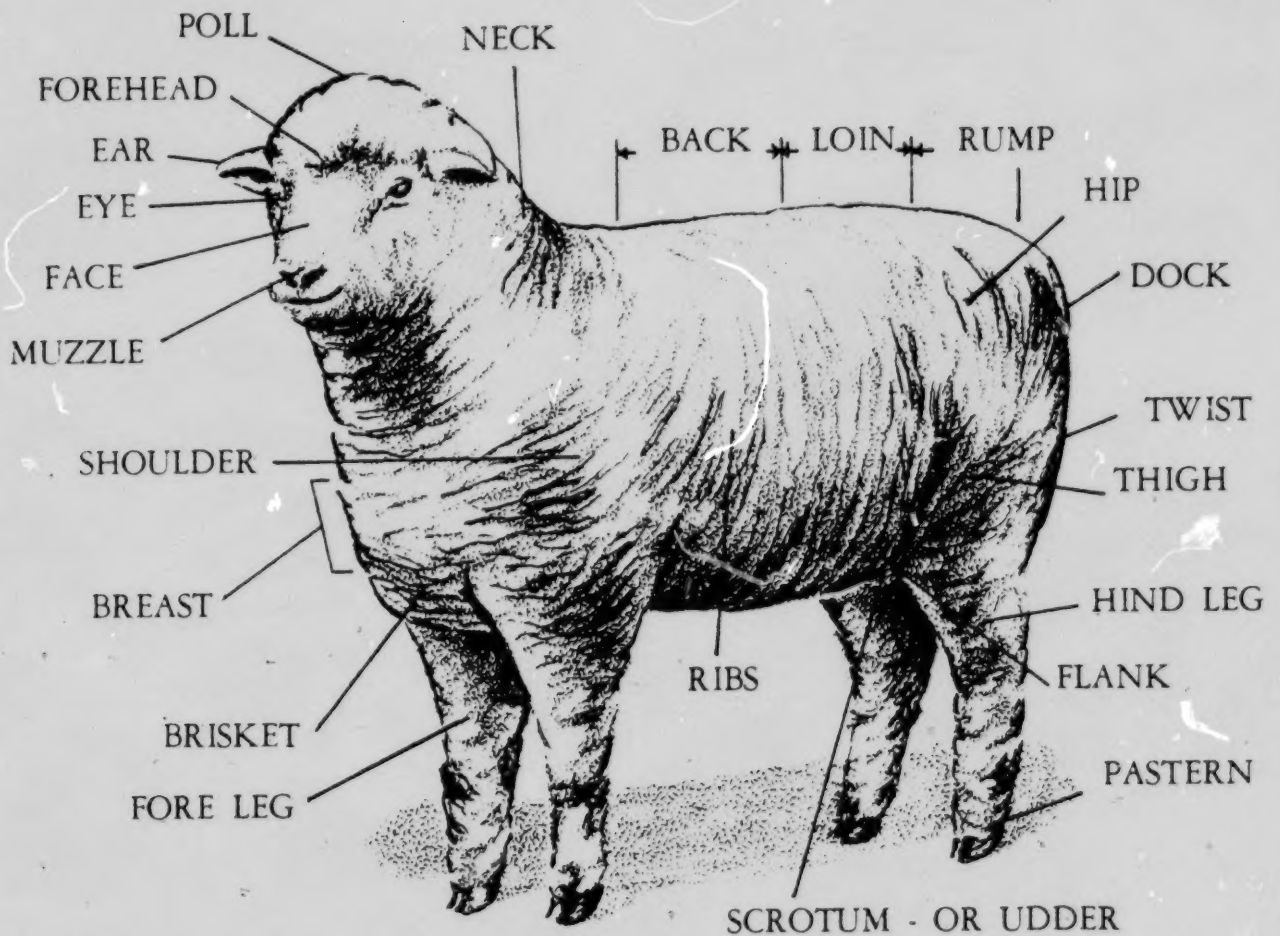
D. Health and Vigor as a Basis for Selection

Health and vigor of breeding sheep and feeder lambs is of utmost importance. In making selections, animals that appear thin and listless or those that show dark skins or paleness in the lining of the nose and eyelids are poor choice.

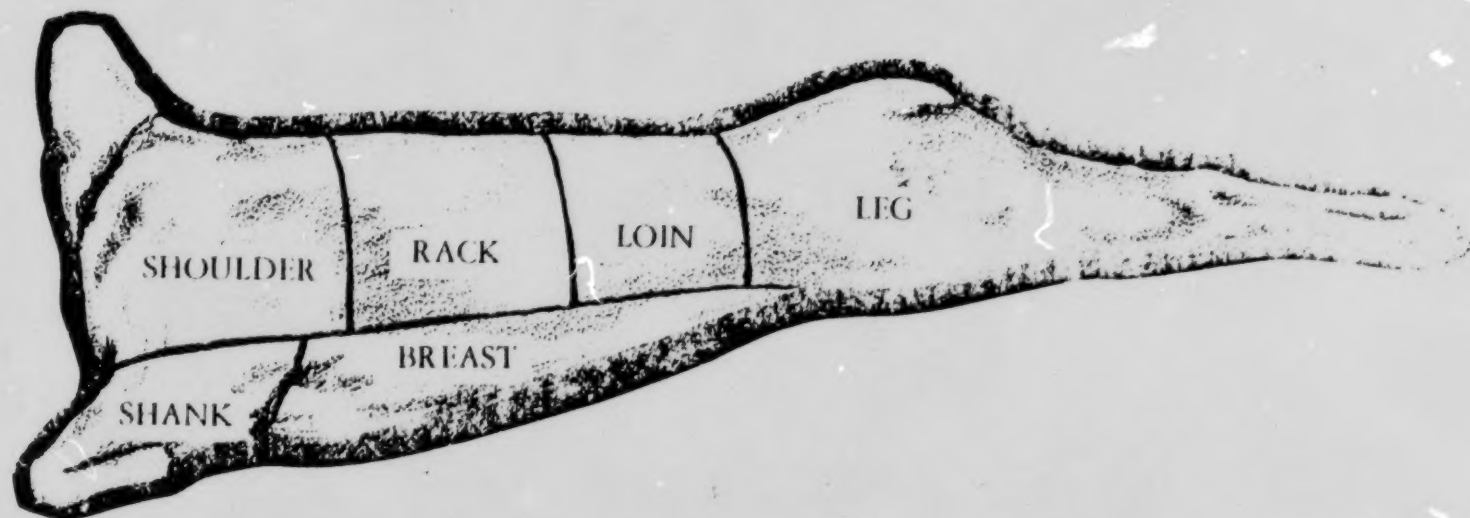
When selecting breeding ewes, one should be observant not to select old ewes with broken mouths or those with unsound udders. A sheep with either jaw protruding beyond the other will have difficulty in grazing. Any ewe that appears enlarged or heavy directly below the rear flank possibly has a weak abdominal wall and should not be selected as a producer.

Only large, smooth, vigorous, healthy ewes should be selected.

PARTS OF A SHEEP



WHOLESALE CUTS OF LAMB



TM-2

AGI-X-47

403

404

IDEAL CONFORMATION



FRONT VIEW



SIDE VIEW



REAR VIEW

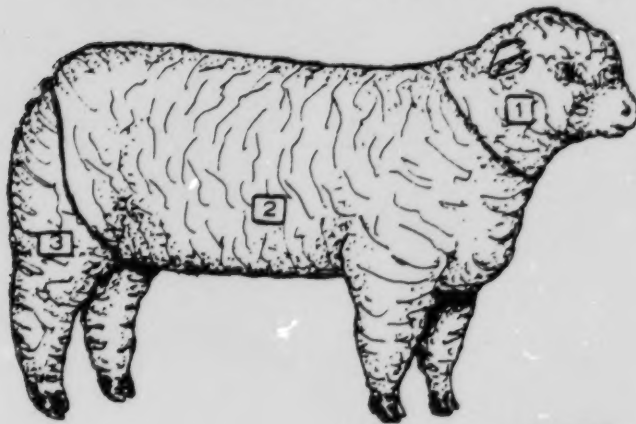
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405

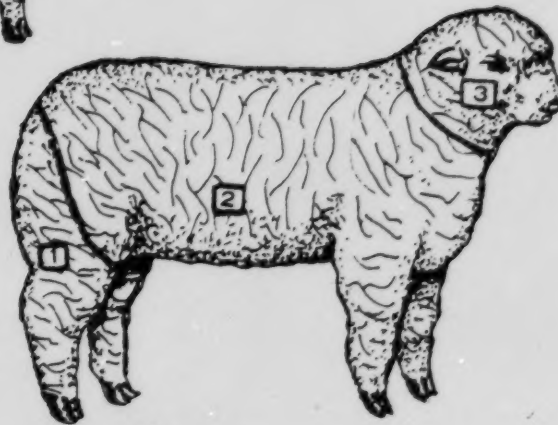
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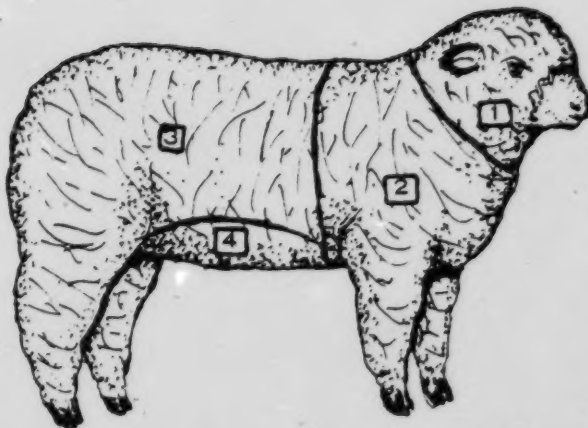
BODY VARIATIONS OF WOOL FINENESS, LENGTH, DENSITY, AND CLEAN WOOL YIELD.



FINENESS



LENGTH



DENSITY



CLEAN WOOL YIELD

SHEEP HERITABILITY ESTIMATES

TRAIT	AVERAGE PERCENT
FACE COVERING	50
STAPLE LENGTH	45
GREASE FLEECE WEIGHT	40
WOOL FIBER FINENESS	40
YEARLING WEIGHT	40
MILK YIELD	30
BIRTH WEIGHT	30
WEANING WEIGHT	30
MULTIPLE BIRTHS	10
CONDITION (FAT)	10
CONFORMATION	9

COMMERCIAL FLOCK RECORD

DATE _____

DESCRIPTION	NUMBER OF HEAD	TOTAL POUNDS OF WOOL	AVERAGE FLEECE WEIGHT	AVERAGE PERCENT LAMB CROP WEANED	AVERAGE WEANING WEIGHT OF LAMBS	AVERAGE WEIGHT OF LAMBS SOLD	REMARKS
TOP EWES							
MIDDLE EWES							
BOTTOM EWES							
REPLACEMENT							
YEARLINGS							
BUCKS							

INDIVIDUAL RECORD FOR RAMS

DATE _____

NUMBER	LENGTH OF STAPLE	WEIGHT OF FLEECE	SHORN BODY WEIGHT	REMARKS

INDIVIDUAL RECORD FOR REGISTERED SHEEP

DATE _____

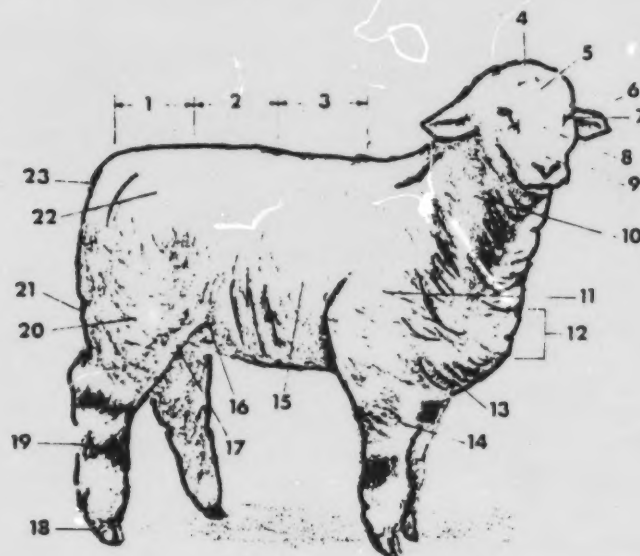
NUMBER	LENGTH OF STAPLE	WEIGHT OF FLEECE	SHORN BODY WEIGHT	WEANING WEIGHT OF LAMBS	REMARKS

SELECTED STUDENT ACTIVITIES

1. What are the purposes for which sheep are generally selected?
 - a.
 - b.
 - c.
 - d.
2. What are some factors on which selection may be based regardless of breed or production method?
 - a.
 - b.
 - c.
 - d.
3. The two products of economic importance to be considered in the selection of sheep are _____ and _____.
4. In observing the sheep's wool and skin, what would a dark appearing skin indicate?

SELECTED STUDENT ACTIVITIES (Continued)

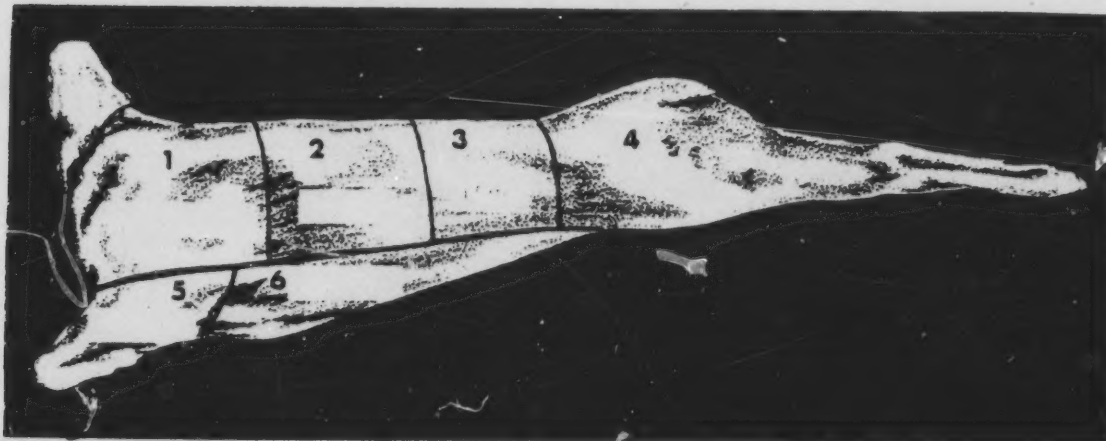
5. List the parts of a sheep as identified on the illustration below:



- | | |
|-----|-----|
| 1. | 13. |
| 2. | 14. |
| 3. | 15. |
| 4. | 16. |
| 5. | 17. |
| 6. | 18. |
| 7. | 19. |
| 8. | 20. |
| 9. | 21. |
| 10. | 22. |
| 11. | 23. |
| 12. | |

SELECTED STUDENT ACTIVITIES (Continued)

6. List the wholesale cuts of lamb as they are identified on the illustration below.



- | | |
|----|----|
| 1. | 3. |
| 2. | 4. |
| 3. | 6. |

7. In your own words, describe the body conformation of an ideal sheep from the following views:

Frontview:

Sideview:

Rearview:

8. Describe what one would look for in the contact step when handling and observing the condition of a breeding sheep.

SELECTED STUDENT ACTIVITIES (Continued)

9. What are the major factors to be considered in the evaluation and classification of wool when selecting sheep.
 - a.
 - b.
 - c.
 - d.
10. At what points on the animal's body is the fleece observed in evaluating the wool?
 - a.
 - b.
 - c.
11. List the traits of sheep which have a heritability estimate above 30%.
 - a.
 - b.
 - c.
 - d.

Local Adaption --- Animal Science

DAIRY BREEDSInstructor's Guide

1. This unit is part of the Local Adaption -- Animal Science set in the Agriculture I guide. Use this unit only if Dairy production is an important Agricultural enterprise within the region served by your vocational agriculture program.
2. Have students write to the breed association to gather information.
3. Have students report their findings.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds and practice selection.
6. Use slide sets of breeds to identify breed traits.
7. Slide sets for Dairy breed identification may be purchased from either of the two sources listed below:
 - a. Vocational Instruction Services
Texas A & M University
F.E. Box 182
College Station, Texas 77843
 - b. Vocational Agricultural Service
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801
8. Make generous use of OSU Extension materials for local adaption.

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed association.
3. Compare the advantages and disadvantages of the breeds.
4. Select the breeds most suited to their location and purposes.
5. Understand and be able to use terms common to the dairy industry.
6. Identify major breeds of dairy cattle.
7. List the physical traits and production characteristics of major breeds.

8. Select animal based on conformation.
9. Understand basic management concepts.

References

1. Gillespie, James R. Modern Livestock & Poultry Production, 1981, Delmar
2. Ensminger, M.E., The Stockman's Handbook, 5th Edition, 1978, Interstate.
3. Hoard's Dairyman.
4. Students materials on Dairy Breeds and Selection from Texas A & M and Illinois.

Teaching Aids

1. Overhead projector with transparencies.
2. Pictures of breeds of dairy cattle.
3. Breed association publications.
4. Slides of dairy breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of dairy cattle.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Glossary of Terms

Adaptation - adjustment to environmental conditions such as climate, biotic factors, etc.

Artificial breeding - the depositing of the male semen in the female reproductive tract.

Calf - without regard to sex under 12 months of age.

Cow - a female of the bovine species after she has had her first calf.

Dam - the female parent of an offspring.

Disposition - the temperamental make-up of an animal.

Diversified - the production of several different kinds or classes of livestock.

Docile temperament - Easily managed disposition.

Dominant - controlling or prevailing over all others; thus, certain genetic traits exert an influence over other traits for similar characteristics in animal breeding.

Heat tolerant - ability of the animal to endure extreme heat conditions.

Heifer - female of the bovine species that has not yet produced a calf.

Homogenization - a mechanical process of distributing fat throughout milk and other dairy products.

Lactation - period female animal gives milk.

Parturition - the act of giving birth to young, applies to all animals.

Pasteurization - the heating of milk to destroy the bacteria in milk and all disease producing bacteria.

Pedigree - a written record of an individual animals' parentage and ancestry.

Productive capacity - ability and performance of a given animal to produce a marketable product.

Purebred - an animal carrying only the blood of some one breed.

Semen - a fluid consisting of spermatozoa and carrier liquids

Sire - in cattle terms, the male parent of the offspring.

Utility - usefulness.

Name _____

AGI-XI-5

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

		AgI-XI-7		
Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,674
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*

TOTAL CROSS FARM SALES	1,742,337	1,494,437	1,253,984
p - Preliminary r - Revised	*Includes nursery crops and turf sod.		

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand								dollars						
THE STATE....	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,683	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,334	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	189,598
Multnomah...	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,070	5,152	1,908	14,744	49,474
Washington.	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,377	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Coos.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook...	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,996	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	687	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,009	38,735
Josephine..	56	439	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	398,246
Gilliam....	20,227	199	226	108	---	---	---	10	20,770	4,208	---	---	182	4,300	25,160
Hood River..	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla...	83,314	6,121	794	19,921	12,237	---	12,167	2,700	137,360	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,250	16,892	2,448	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,109
Wallowa....	6,244	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes..	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Harney....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson...	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,880	682	1,960	36,822	83,619
Lake.....	1,131	2,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

OREGON
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand dollars														
THE STATE...	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,494,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,251
Benton....	3,870	386	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas..	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Cane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	1,860	50,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah..	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,002	1,823	12,443	44,495
Washington.	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop....	---	43	---	---	---	112	8	1,930	2,094	1,455	1,400	3	1,886	4,744	6,838
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook..	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,091
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,536	37,390
Josephine..	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	583	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River..	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,630	42,378
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	766	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa....	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes..	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,986
Jefferson..	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

Breeds of Dairy Cattle

*Terms: All terms underlined are included in the "Glossary of terms."

Note: A slide set, "Breeds of Dairy Cattle," is available from Vocational Instructional Services, Texas.

1. Importance of the Breed

The production of dairy products represents a major enterprise within the agricultural economy of this country. The income from the sale of dairy products represents about 13% of the nation's farm income each year. The development of pasturization, refrigeration, homogenization, and methods of milk processing have brought about this advancement. Milk is the most nearly perfect food as it contains most of the nutrients required by humans.

Dairy production has become so scientific and specialized that most operations are no longer diversified. However, in some instances, dairy production does fit into other farm operations. The labor requirements and costs require diversification for efficiency in smaller operations.

The use of highly controlled selection and breeding programs based on performance records has resulted in increased production in dairy cattle. In many areas a trend toward replacement herd purchasing of proven cows and heifers of proven parentage has greatly increased production. A trend toward breeding dairy cattle to beef bulls is increasing as there is a demand for such crosses by commercial beef producers in crossbreeding programs. Many dairymen are using frozen semen from the exotic beef bulls as they are already engaged in artificial breeding programs.

These trends provide for a highly desirable situation as the production of the milking herd is raised and an additional income is provided from the sale of the crossbred calves.

In programs where replacements are raised, artificial breeding provides for the use of the semen of proven dairy sires to all breeders.

There is no one best breed of dairy cattle; however, a certain breed may be better adapted to certain environmental conditions and market demands and, from these standpoints, is better for a particular individual. Each of the breeds has certain advantages, and it is a matter of weighing and comparing the advantages with the disadvantages in selecting a breed.

An important consideration to remember is that there are outstanding cows in every breed, and the difference between breeds may be of lesser importance than the differences of individual animals within the breed. When the breed that is best suited to the production program has been selected, then major emphasis should be placed upon the breeding or selecting of individual cows which will be most productive. The person making the selection should always bear in mind that utility, adaptation, and productive capacity are important qualities to consider in selecting a breed.

The five major breeds of dairy cattle that will be discussed in this topic are the Ayrshire, the Brown Swiss, the Guernsey, the Holstein-Friesian, and the Jersey. Three other dairy breeds that are found in smaller numbers, but which will be discussed, are the Dutch Belted, the Milking Shorthorn, and the Red Danish.

BREEDS	ORIGIN	CHARACTERISTICS
1. Ayrshire	A. Originated in Scotland B. First imported in 1822	(1) Color..... Red with white markings or white with red markings with the red ranging from light to very dark. (2) Horned..... Characterized by long horns that turn upward. (3) Size..... (a) Fairly large; usually between Guernsey and Holstein (b) Average Mature Weight: (1) Male: 1600-2300 lbs. (2) Female: 1100-1300 lbs. (3) Calves at birth weigh 70-80 lbs. (4) Temperament..... Females are active and prove to be nervous; bulls may be vicious. (5) Production..... (a) Milk-average production (b) Butterfat-average around 4% (6) Considered by many to be the most attractive dairy breed. Animals are noted for straight top lines, level rumps, and good udders.
2. Brown Swiss	A. Developed in the mountainous areas of Switzerland B. First imported in 1869 at Belmont, Massachusetts C. One of the oldest and purest dairy breeds	(1) Color..... Varies from light fawn to almost black, horn tips and switch are black and stripe along backbone and legs are generally light in color.

BREED

ORIGIN

CHARACTERISTICS

Brown Swiss (Continued)

- (2) Size..... (a) The largest, most rugged dairy cattle, demonstrate beef characteristics.
 (b) Cattle have large bones, a large head, and thick, loose skins.
 (c) Average Mature Weight:
 (1) Male: 1800-2400 lbs.
 (2) Female: 1200-1400 lbs.
- (3) Temperament..... Quiet, docile, and easily managed.
- (4) Production..... (a) Milk-average producers being similar to the Ayrshire in lbs. of production.
 (b) Butterfat-average around 4%.
- (5) Calves at birth weigh from 80-125 lbs. and studies indicate that they gain rapidly and make desirable veal at an early age.

3. Gurnsey

- A. Island of Guernsey off the coast of France in 1831
- B. Often referred to as the "Golden Guernsey" because of the rich yellow color of the milk

- (1) Color..... (a) Varies from a light fawn to red with white markings on face, legs, switch, and flank.
 (b) The nose should be buff or cream colored and the skin yellow.
- (2) Horned
- (3) Size..... (a) Smaller framed, less rugged than Holstein.

BREED

ORIGIN

CHARACTERISTICS

- (b) Average Mature Weight:
 - (1) Male: 1500-1800 lbs.
 - (2) Female: 800-1100 lbs.
- (c) Calves at birth weigh 65 to 75 lbs.

(4) Temperament..... Females are active but not nervous; bulls are generally docile but may be vicious if mishandled.

- (5) Production.....
- (a) Milk-high producers but usually not as high as the Holstein.
 - (b) Butterfat-averages from about 4.5% to 5%.
 - (c) Milk quite often sells at a premium on the market because of its golden color.

4. Holstein-Friesian

A. Originated in Holland and were called Friesians

(1) Color..... Black and white, ranging from white with a few black spots to almost black.

B. First imported in 1625

(2) Horned

C. Bred to produce a large amount of milk

- (3) Size.....
- (a) Large, framed and ruggedly built with large feeding capacities and udders.
 - (b) Average Mature Weight:
 - (1) Male: 1700-2000 lbs.
 - (2) Female: 1100-1600 lbs.
 - (3) Calves weigh 85 to 95 lbs. at birth and are large and vigorous.

Holstein-Friesian (Continued)

- (4) Temperament..... Females are quiet and docile but bulls may be vicious.
- (5) Production..... (a) Milk-one of the highest producing breeds in total pounds.
(b) Butterfat-low percentage averaging about 3.5% but due to large amount of milk produced, rate high in total butterfat production.
- (6) A summary of the nation's DHIA records shows that more Holsteins were reported than all other dairy breeds combined.

E. Jersey

A. Originated on the
Island of Jersey in
the English Channel

- (1) Color..... (a) Body varies from light fawn to black and from spotted to solid colored.
(b) The switch may be black or white, the muzzle is generally black, and the tongue may be black or white.
- (2) Horned
- (3) Size..... (a) The Jersey is the smallest of the dairy breeds but approaches the true dairy type.
(b) Average Mature Weight:
(1) Male: 1200-1500 lbs.
(2) Female: 600-900 lbs.

BREED

ORIGIN

CHARACTERISTICS

Jersey (Continued)

- (3) Claves weigh 50-60 lbs. at birth.
- (4) Temperament..... Females inclined to be nervous and sensitive but are very docile under good management. Bulls are prone to be quite vicious.
- (5) Production..... (a) Milk-do-not produce as large quantity as the larger breeds
(b) Butterfat-averages about 5.3%
(c) Milk sells at a premium because of its superior quantity.
- (6) Good dairy character is reflected in straight top lines, level rumps, and sharp withers.

III. Other Dairy Type Breeds

1. Dutch Belted

A. Native to Holland

B. First imported in 1840 as an exhibition feature of the Barnum & Bailey Circus

- (1) Color..... Black with white belt encircling the body between the hocks and front legs not less than six inches at the narrowest point.
- (2) Size..... (a) Large cattle showing same beef characteristics
(b) Average Mature Weight:
(1) Male: 1600-2000 lbs.
(2) Female: 1100-1300 lbs.
- (3) Temperament..... Docile, easily handled.

BREEDS

ORIGIN

CHARACTERISTICS

Dutch Belted (Continued)

- (4) Production..... (a) Good profitable milk producers under ordinary conditions.
(b) Butterfat tests 3.5% to 5.5%.

Transparency No. 1

A comparison of some of the common characteristics of the five major dairy breeds is given in table form. These characteristics on which the breeds are compared include mature cow size, milk production, percent butterfat, size of calves at birth, cattle registrations, and butterfat production.

BREEDREGISTRIES & ASSOCIATIONSMajor Breeds

A. Ayrshire	Ayrshire Breeders Association Brandon, VT 05773
B. Brown Swiss	Brown Swiss Cattle Breeders Association Box 1038 Beloit, WI 53511
C. Guernsey	American Guernsey Cattle Club 70 Main Street Peterborough, NH 03458
D. Holstein-Friesian	Holstein-Friesian Association of America P.O. Box 808 Battleboro, VT 05301
E. Jersey	American Jersey Cattle Club 2105-J South Hamilton Road Columbus, OH 43227

Other Breeds

A. Dutch Belted	Dutch Belted Cattle Association of America P.O. Box 35B, Highlands County Venus, FL 33960
B. Milking Shorthorn	American Milking Shorthorn Society 1722 - JJS Glenstone Springfield, MO 65802
C. Red Danish	American Red Danish Cattle Association Marlette, MI 48453

CHARACTERISTICS OF THE MAJOR DAIRY BREEDS

BREED	MATURE COW SIZE (lbs.)	*MILK PRODUCTION (lbs.)	*PERCENT BUTTERFAT	*BUTTERFAT PRODUCTION (lbs.)	SIZE OF CALVES AT BIRTH (lbs.)	CATTLE REGISTRATION 1972-73
AYRSHIRE	1100 to 1300	10,312	4.0	415	70 to 80	13,883
BROWN SWISS	1200 to 1400	10,860	4.1	446	90 to 100	15,294
GUERNSEY	800 to 1100	9,179	4.7	436	65 to 75	34,451
HOLSTEIN-FRIESIAN	1100 to 1400	12,684	3.7	466	85 to 95	277,851
JERSEY	600 to 900	8,319	5.1	423	50 to 60	39,396

*These figures were taken from the 1965-66 DHIA records and represent the averages for the various breeds.

SELECTED STUDENT ACTIVITIES

1. Write the name of the dairy breed in the space that is provided for each description given below.

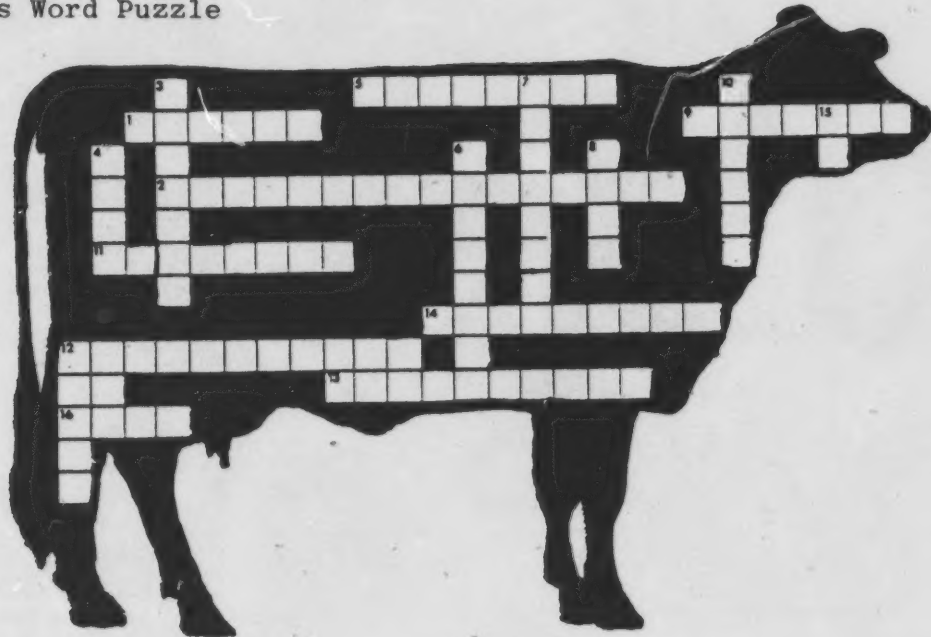
_____ Largest, most rugged, and meatiest breed of dairy cattle
 _____ Earliest maturing females of the dairy cattle breeds
 _____ Considered by many as the most attractive dairy breed
 _____ Large red cattle showing some beef characteristics
 _____ First imported by Barnum and Bailey Circus in 1840
 _____ Cows produce golden yellow milk which often sells at a premium
 _____ Leads all other breeds in cattle registrations
 _____ Dual purpose cattle known as the red, white, and roan breed

2. Which of the dairy breeds is found in largest numbers in your county or locality?
3. Select the dairy breed of your choice and write to the breed association for additional information and pictures.
4. In the chart below, rank the five major dairy breeds from 1 to 5 according to the characteristic listed at the top of each column. Use number 1 to represent the smaller or lesser amount.

Characteristics of the Major Dairy Breeds

Breed	Mature Cow Size (lbs.)	*Milk Production (lbs.)	*Percent Butterfat	Cattle Registrations 1972-73	Size of Calves at Birth (lbs.)	*Butterfat Production (lbs.)
Ayrshire						
Brown Swiss						
Guernsey						
Holstein- Friesian						
Jersey						

5. Cross Word Puzzle

ACROSS

1. Smallest of the dairy breeds
2. Red and white color combinations characterize this breed, but neither color is dominant.
5. Intermediate in size and light fawn color with white markings
9. Origin of the Dutch Belted and Holstein breeds.
11. These cattle have long horns that turn upward.
12. Origin of the Brown Swiss breed.
13. Cows of this breed generally have the largest calves at birth.
14. First imported from Denmark in 1933
16. Even though dairy cattle numbers have decreased, the total _____ production has increased.

DOWN

3. Origin of the Red Danish breed
4. Records of milk production and butterfat content
6. Highest milk producing breed with lowest butterfat content
7. Origin of the Ayshire breed
8. One of the preferred colors in Milking Shorthorn cattle
10. Easily managed disposition
12. Fluid produced by reproductive organs of the male
15. Abbreviation for artificial insemination

Dairy Cattle Management

Instructor's Guide

The following information is needed by freshman students as a basis to begin their dairy projects. This information should be made available to all students to aid them in their dairy projects. It is not a complete management unit, however, it does represent important basic facts and rules of thumb.

THUMB RULES FOR DAIRY CATTLE

1. Allow free access to grain until calf consumes 3-4 lbs. daily, then limit the amount to that figure.
2. Feed 2 lbs. of hay per day for every 100 lbs. of body weight. Or 1 lb. hay and 3 lbs. of silage for every 100 lbs. of body weight.
3. For low test breeds feed one lb. of concentrate for every 3-4 lbs. of milk produced.
4. For high test breeds feed one lb. for every 2½ to 3½ lbs. of milk produced.
5. Feed calf 0.5 lbs. of milk for each 10 lbs. of body weight, twice a day.
6. 100 lb. calf requires about 500 lbs. of milk to reach market weight.
7. 1 lb. grain requires about 10 lbs. of milk.
8. Breed Jerseys and Guernseys to freshen at 22-24 months and other breeds at 24-26 months.
9. Open stanchion
Manger space 27-30 in. per cow
Loafing area 60 sq. ft. per cow
10. Average cow has to be 4 years old before she starts to break even on cost of production.
11. First calf heifer produces only 3/4 of the milk as she will produce when she is 6 years old.
12. To change milk and B.F. for 365 days to 305 days multiply 0.833.
13. Animal units for pasture:
one 1300 lb. cow = 7 sheep = 5 hogs = 100 hens = 50 turkeys.

Unusual Feeds for Dairy Cattle

Today, more than ever before, the dairymen in this area are using by-products in the dairy grain mix. Each of these products has some value when mixed with overall grain ration.

The value of any grain ration can be determined only by adding up "feeding value" of each of its parts. A dairy grain mix should contain from 12-16% crude protein and at least 70-75% of this ration should be digested.

General

1. A cow is twice the value of a steer. A bull is three times the value of a steer.
2. Best market weight for veal calves - 140-150 lbs.
3. Castrate calves at 4-10 weeks.

4. If selling steers just off the range, sell before Labor Day
5. Gain pays for feed. At the same price, gain in animal weight pays for the cost of additional feed.

Barley is the chief grain used in the dairy grain mixtures. It is a common practice to compare many of the other grains and by-products to barley on the basis of overall digestibility. The following table, assembled by the Division of Animal Husbandry at Oregon State University, Corvallis, compares many of these products now available as feed.

Dairymen mixing their own feed can use the following table as a guide in making purchases of concentrate for their grain mixes.

<u>Feed</u>	<u>Moisture</u> (%)	<u>Value as compared Barley</u> (%)	<u>Digestible Crude Protein</u> (%)	<u>Total Digestible Nutrients</u> (%)
Barley (Pacific Coast)	11.0	100	7.3	73.0
Almond Hulls	10	91	0.0	72.0
Brewers Grains (wet fed alone)	76	13	.6	10.0
Potatoes, dried	7	91	3.7	71.4
Sunflower meal	5	46	15.0	36.0
Urea	6	0	281 equiv.	0
Wheat (Pacific Coast)	11	106	9.9	78.0
Grass seed screenings	7	85	11.0	70.0?
Feather meal	9	85	60.0	62.0
Grass straw	0	0	4.0	45.0?
Whole cotton seed	8	71	14.6	52.0
Whey (liquid)	93	8	1.0	5.8

How can a dairyman use this table of usual feeds? Let's set up an example.

Assume that rolled barley is selling for \$77 per ton delivered. What can a person afford to pay for good quality sunflower meal?

1. We find from the table, that sunflower meal is worth around 46% the value of barley (on a total digestible nutrient basis).
2. Therefore:

$$\frac{\text{Percentage Value of a Feed Stuff as compared to barley}}{\text{Percentage Value of a Feed Stuff as compared to barley}} \times \frac{\text{Today's Market Price}}{\text{Today's Market Price}} = \frac{\text{Price per ton that can be paid for feed stuff}}{\text{Price per ton that can be paid for feed stuff}}$$

$$.46 \times \$77 = \$35.42$$

A person therefore can afford to pay in the neighborhood of \$35.00 per ton for sunflower meal, when compared to barley on a total digestible nutrient basis.

It must be remembered that these unusual feeds will only replace a part of the grains in a dairy mix. Many, if fed in quantities of over 25%-30% of the total ration will cause difficulties.

This same method can be used to determine the price to pay for other "unusual feeds" as compared to the standard grain, barley.

Selecting Dairy Cattle

*Terms: All terms underlined are included in the "Glossary of Terms."

The five common breeds of dairy cattle are the Ayrshire, the Brown Swiss, the Guernsey, the Holstein-Friesian, and the Jersey. Although there is no one best breed, there may be a particular breed that is preferred by the individual dairyman because it is better adapted to certain environmental conditions and market demands.

I. Factor to Consider in Selecting a Dairy Breed

Selecting a breed of dairy cattle is like selecting any other item where the individual has a variety from which to choose. Quite often after considering all the advantages and disadvantages, personal preference may be the determining factor.

It would be advisable for one to consider each of the factors below in selecting a breed of dairy cattle.

- A. The availability of breeding stock of the type and quality that is desired by the individual should be considered.
- B. The dairy markets for milk and butterfat may influence the choice of breeds.
- C. The availability of forage crops and pastures may be an important consideration since the larger and more rugged breeds require more roughages.
- D. Since breeds differ in their ability to withstand high and low temperatures, climatic conditions should be considered.
- E. The heifers of larger breeds do not usually mature and come into production as early as the smaller breeds; therefore, age of maturity is a factor.
- F. It may be an advantage to choose the breed most popular in the community from the standpoint of having a source of breeding stock and a market for surplus stock.
- G. The size and vigor of newborn calves should be considered as replacement prospects and also from the standpoint of calving difficulties.

II. Selecting Individual Animals

Factors that should be considered in selecting a dairy animal are type or physical appearance, production records, pedigree, and health and vigor. In addition to the four previously mentioned factors, mammary development should be considered when selecting dairy heifers.

One would prefer to use all of the above factors as a basis of selection; however, this is rarely possible because records are incomplete on most animals.

A. Type as a Basis for Selection

Since type and production are usually closely correlated, it is necessary that the prospective dairyman be familiar with correct dairy type. Type is important because it indicates that the animal has the conformation and physical characteristics for high milk production.

Transparency No. 1

Prior to becoming familiar with dairy type, one should learn the parts of a dairy cow. This is necessary so that a person can understand the terminology applied to those parts and to be able to follow the discussion related to the selection of dairy animals.

Transparency No. 2

The five major dairy breed associations of the United States have cooperated through the Purebred Dairy Cattle Association to develop a unified score card for dairy cows and bulls that has been approved by all of these dairy breeds. The unified score card indicates the points or criteria to be considered in selecting dairy animals and the emphasis to be given each point.

The four major areas included on the score card are: (1) general appearance, (2) dairy character, (3) body capacity, and (4) mammary system.

Each of the four major areas are further subdivided and the relative importance of each characteristic is designated by points on the score card. Every person should become familiar with the score card; it will assist him/her in selecting dairy animals.

Transparency No. 3

In an effort to improve dairy type and thus increase production, each breed association has a type classification score card used by an official classifier to rate animals within the breed as to type or general appearance.

One should follow a definite order of inspecting dairy animals. The same recommendations for inspecting beef animals are recommended for selecting dairy animals. To briefly review the procedure, one should use the following order of inspection: Step 1, sideview; Step 2, rear view, Step 3, front view; and Step 4, contact step. The animal is observed from approximately 20 feet in the first three steps, and close inspection of the animal is made in step four.

Note: Your attention is called to the characteristics listed under transparencies number four through six. Only a few of the characteristics are listed. Undoubtedly,

you will see many more that should be discussed with your students.

Transparency No. 4

Some characteristics that should be considered when discussing desirable and undesirable general appearance and dairy character are:

<u>General Appearance</u>	<u>Dairy Character</u>
1. Size	1. Milking ability
2. Head	2. Angularity
3. Shoulders	3. Freedom from coarseness
4. Back	4. Neck
5. Hook bones	5. Withers
6. Rump	6. Ribs
7. Legs and feet	7. Flanks
8. Breed characteristics	8. Thighs
	9. Skin

Transparency No. 5

Barrel and heart girth are the major characteristics to consider in determining body capacity of a dairy animal. Characteristics that may be considered are:

<u>Barrell</u>	<u>Heart Girth</u>
1. Long, deep barrel	1. Large, deep heart girth
2. Ribs widely sprung	2. Full crops
3. Depth of barrel tending to increase toward rear	3. Wide chest floor
	4. Blending of heart girth and shoulders

Transparency No. 6

Some characteristics of the udder are:

Udder-Strongly attached, well balanced, wide and deep, soft and pliable

Fore udder-Uniform width from front to rear, moderate length.

Rear udder-High, wide, strongly attached, uniform.

Teats-Medium length, squarely placed, plumb.

Mammary veins-Large, long, tortuous.

B. Production Records as a Basis for Selection

Production records take much guesswork out of selecting dairy animals; they will show the productive capacity of the cow and give an indication of the possible production of the offspring. Since the production records of a purebred animal and of its ancestors are recorded on the pedigree, increasingly large numbers of dairy herds are being tested in dairy herd improvement association programs.

Producers who keep production records usually keep one of the following three types: (1) DHIA (Dairy Herd Improvement Association), (2) Weigh-A-Day-A-Month, and (3) Owner-Sampling Testing Records.

Each of these types involves weighing the milk produced by each cow in the herd one day a month. Milk samples from individual cows can be collected when a butterfat test is to be made. Other records usually kept with production records are freshening dates, drying dates, and breeding dates.

1. The Dairy Herd Improvement Association, DHIA, which is supervised by the U.S.D.A. Agricultural Research Service, Dairy Cattle Research Branch, State Agricultural Extension Services, and the local DHIA Board of Directors, provides maximum information of production and feeding for each cow in the herd. The actual testing of the cows is carried out by an approved tester who visits the dairy one day each month to weigh and sample milk, make butterfat tests, and calculate production and feed records. This information is sent to data processing centers for computation and summarization and is then returned to the producer. The report contains individual cow's records such as daily milk weights, butterfat percent, concentrates fed, reproductive status, value of milk produced, feed cost, and income over feed cost. It also contains a herd summary for the test period.
2. The dairy producers keeping the Weigh-A-Day-A-Month records weighs the milk from each cow one day a month. They multiply the day's production by the number of days in the month to get the monthly production per cow. They also record freshening dates, drying dates, and breeding dates on each cow in the herd.
3. The Owner-Sampler Records are kept by dairy-producers interested in a less expensive herd improvement and testing plan. Dairy-producers using this plan weigh and sample each cow's milk one day each month, and the tester picks up the samples and calculates the results. Because the dairy-producer takes their own sample, this is not an official test; nevertheless, the information received by the dairy-producer is important to efficient management.

Transparency No. 7

Dairy Herd Improvement Records -This form, DHI-201, shows an example of the type of information that is recorded on the DHIA.

Transparency No. 8

The age conversion table will serve as a guide for estimating dairy animals' productive capacity; however, more accurate tables are available. The productive capacity of dairy animals tends to vary in the geographic areas of the U.S.. The age conversion table developed for your

area would give a more accurate estimate of a cow's production.

Production records are a good indication of the cow's productive capacity; but the records can be influenced by the time of calving, number of milkings per day, length of previous dry period, age, kind and amount of feed, month of lactation, and management practices. One should consider the above factors when examining production records. Possibly the greatest returns a dairy-producer receives for his/her labor is the time he/she spends keeping accurate herd, and other, records. Accurate records will serve as a guide to most of the management decisions made by dairymen.

How to use the Conversion Tables:

Suppose you have a Holstein cow that has just completed a 315-day lactation record which she began as a 4-year old. She was milked three times daily and produced 500 pounds of butterfat. First, look at the "Age" section. The production of a 4-year-old Holstein should be multiplied by 1.08, so multiply 500×1.08 , which equals 540 pounds of butterfat.

Next look at the "3x Milking Records" section and multiply $540 \times .87$, which equals 469 pounds of butterfat.

Finally, look at the "Length of Lactation" section. A 315-day lactation record should be multiplied by .98. By multiplying $469 \times .98$ the final answer is 460 pounds of butterfat.

Finally, look at the "Length of Lactation" section. A 315-day lactation record should be multiplied by .98. By multiplying $469 \times .98$ the final answer is 460 pounds of butterfat. This figure now is standardized and can be plotted on the arrow chart.

C. The Pedigree as a Basis for Selection

Transparency No. 9

The pedigree lists the ancestors of an animal; and in some instances, the pedigree includes the production records and type classification of the animal and some of its ancestors. Most pedigrees show three generations, but some breed associations will provide extended pedigrees showing several generations. Usually an additional fee is charged for an extended pedigree.

When using the pedigree as a basis of selection, the most consideration should be given to the sire and dam, as they contribute fifty percent to the animal's makeup. The other ancestors contribute the other fifty percent. The more production records shown on the pedigree, the more reliable the information as to the possible production capacity of the animal under consideration.

Transparency No. 10

Other important factors in selecting dairy animals are character and heritability estimates. To assist in determining the estimated heritability of a given factor, the following example is given. If from a herd of cows averaging 13,000 pounds of milk heifers were selected from 16,000 pound dams, how much of the 3,000 pounds superiority of the cows would show up in the offspring?

Since the cow contributes half to the offspring, the 3,000 pounds superiority should be divided by two, which equals 1,500 pounds. According to the heritability chart, milk production is twenty-five percent heritable. Multiply 1500 x .25 to get the estimated increase in milk production of the offspring. The offspring of the selected parents in the above example would have a predicted increase of 375 pounds of milk over the present herd average.

The following table gives the approximate heritability percent of some of the inherited traits in dairy cattle.

HERITABILITY ESTIMATES OF DAIRY CATTLE

<u>Trait</u>	<u>Average Percent</u>
Fat test	50
Protein Test	50
Size	50
Birth weight	45
Weight	35
Gestation length	35
Fore and rear udder	35
General appearance	33
Type	30
Dairy character	30
Milk yields	25
Mastitis	25
Breed character	25
Milking quality	24
Body capacity	23
Udder depth	22
Teats, veins, and quality	20
Feet, legs	18
Longevity	10
Udder size and shape	7
Teat length	5
Reproductive performance	3
Service/conception	3

The above data was obtained from "Livestock Breeding," Department of Agricultural Education, Ohio State University.

D. Health and Vigor as a Factor in Selecting Animals

Health and vigor should be considered in the selection of dairy animals. The general health of the herd can be determined by the calving record of the cows during the past year, the number of cows in production, the stages of production, and the amount of milk being produced.

The most serious causes of health problems in dairy herds are sterility, mastitis, udder troubles, Bang's disease, leptospirosis, and tuberculosis. It is desirable to buy animals only from herds that have been vaccinated or tested for Bang's disease and tested for tuberculosis and leptospirosis. If animals purchased have not been tested within the last thirty days for Bang's disease and tuberculosis, the animals should be tested before being purchased. To minimize health problems, one should select animals from a reputable breeder of a disease-free herd.

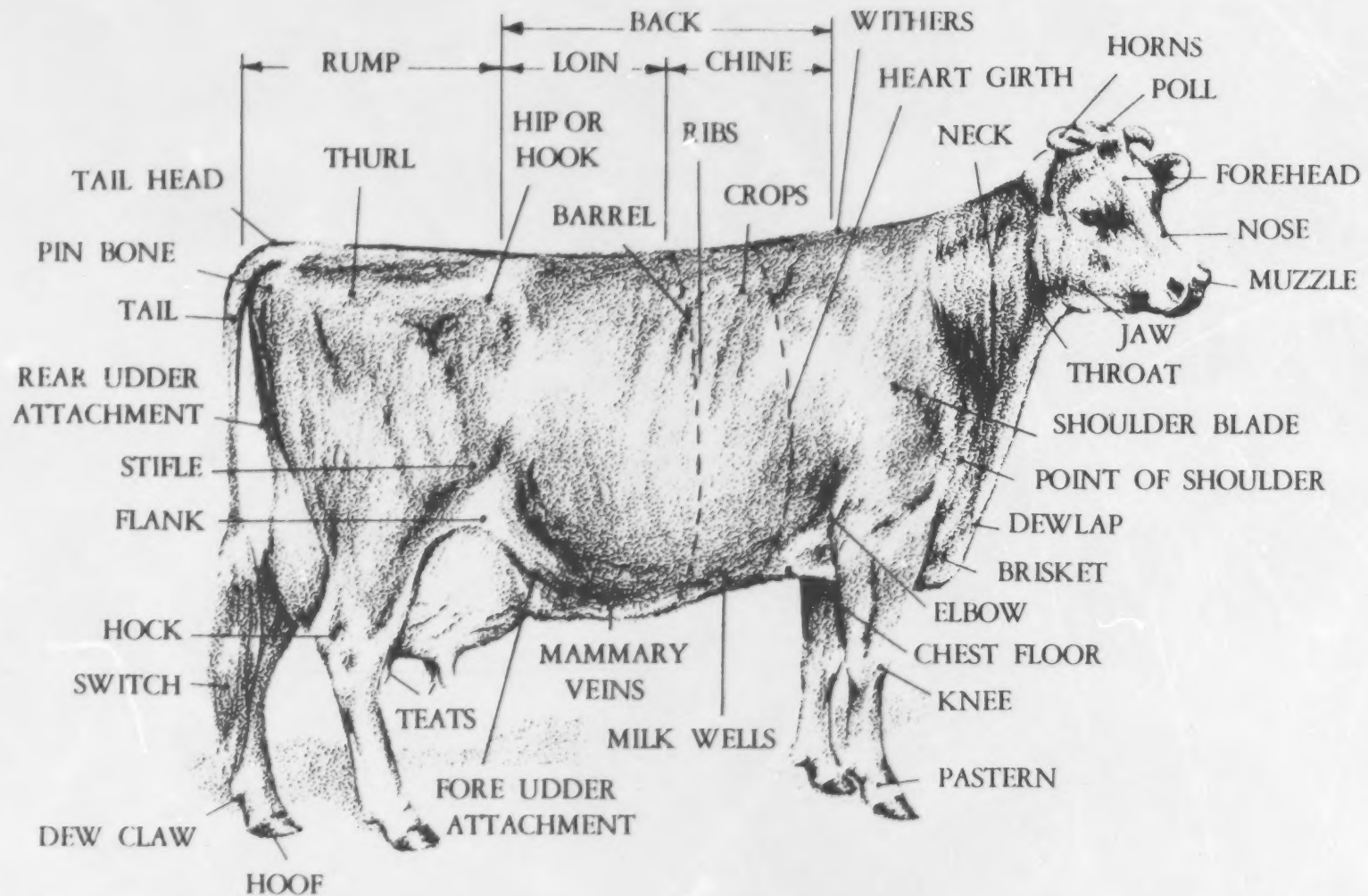
E. Mammary Development as a Factor in Selecting Dairy Heifers

Transparency No. 11

A dairy heifer's mammary glands develop in a definite pattern, according to the Dairy Department at the U.S.D.A. Beltsville Research Center. The gland starts in each quarter as a small vertical tube that extends from the teat upward toward the body. At four to six weeks of age, these tubes begin to thicken in the center; and as they enlarge, they tilt back toward a horizontal position.

In 50 to 75 percent of the udders of heifers at four months of age, the front and rear glands had fused, or joined, leaving a well defined V-shaped depression or notch above the fusion. The depression or notch between the front and rear quarters becomes less pronounced as the udder grows. The gland size is an important factor in selecting heifers. The larger the gland at a given age, the better milker the cow should be.

PARTS OF A DAIRY COW



TM-1

AgI-XI-33

DAIRY COW UNIFIED SCORE CARD

AgI-XI-34

BREED CHARACTERISTICS SHOULD BE CONSIDERED IN THE APPLICATION OF THIS SCORE CARD	Perfect Score
---	------------------

Order of Observation

1. GENERAL APPEARANCE 30

(ATTRACTIVE INDIVIDUALITY WITH FEMININITY, VIGOR, STRETCH, SCALE, HARMONIOUS BLENDING OF ALL PARTS AND IMPRESSIVE STYLE AND CARRIAGE. ALL PARTS OF A COW SHOULD BE CONSIDERED IN EVALUATING A COW'S GENERAL APPEARANCE)

BREED CHARACTERISTICS	10
COLOR	
SIZE	
HEAD	
SHOULDER BLADES	10
BACK	
RUMP	
LEGS AND FEET	10

2. DAIRY CHARACTER 20

(EVIDENCE OF MILKING ABILITY, ANGULARITY, AND GENERAL OPENNESS, WITHOUT WEAKNESS, FREEDOM FROM COARSENESS, GIVING DUE REGARD TO PERIOD OF LACTATION)

NECK, WITHERS, RIBS, FLANKS, THIGHS, AND SKIN.	20
--	----

3. BODY CAPACITY 20

(RELATIVELY LARGE IN PROPORTION TO SIZE OF ANIMAL, PROVIDING AMPLE CAPACITY, STRENGTH, AND VIGOR)

BARREL	10
HEART GIRTH	10

4. MAMMARY SYSTEM 30

(A STRONGLY ATTACHED, WELL BALANCED, CAPACIOUS UDDER OF FINE TEXTURE INDICATING HEAVY PRODUCTION AND A LONG PERIOD OF USEFULNESS)

UDDER	10
FORE UDDER	6
REAR UDDER	7
TEATS	5
MAMMARY VEINS	2

CLASSIFIER'S REPORT OF HERD CLASSIFICATION

SIRE NUMBER	ANIMAL NUMBER	NAME OF ANIMAL	DATE OF BIRTH			FIN	GEN	DAIR	BOD	MAM	STA	HEAD	FRON	BACK	RUM	HIND	FEET	FOR	REAR	UDD	ANL	QUA	TEA	MIS
			MO.	DAY	YR.																			
1000000	4567891	PRAIRIE VIEW SALLY	06	08	56	90	E	E	E	E	1	3	2	1	1	2	1	2	1	2	2	1		

TERMS—GENERAL

STATURE

1. UPSTANDING
2. INTERMEDIATE
3. LOW SET

HEAD

1. CLEAN-CUT, WELL-PROPORTIONED WITH STYLE AND STRENGTH
2. STRONG-LACKING STYLE
3. SHORT
4. PLAIN AND/OR COARSE
5. WEAK

FRONT END

1. SHOULDER SMOOTHLY BLENDED, CHEST STRONG AND WIDE
2. MEDIUM STRENGTH AND WIDTH
3. COARSE SHOULDER AND NECK
4. NARROW AND WEAK

BACK

1. STRAIGHT, FULL CROPS, STRONG
2. LACK OF DEFINED HALVING
3. FLOOR TOO LOW
4. TILTED
5. BROKEN SUSPENSORY LIGAMENT AND/OR WEAK FLOOR

UDDER QUALITY

1. SOFT AND PLIABLE
2. INTERMEDIATE
3. COULD NOT DETERMINE
4. MEATY

TEAT SIZE AND PLACEMENT

1. PLUMB, DESIRABLE LENGTH AND SIZE AND SQUARELY PLACED
2. TOO CLOSE ON SIDE
3. REAR TEATS BACK TOO FAR
4. WIDE FRONT TEATS
5. UNDESIRABLE SHAPE

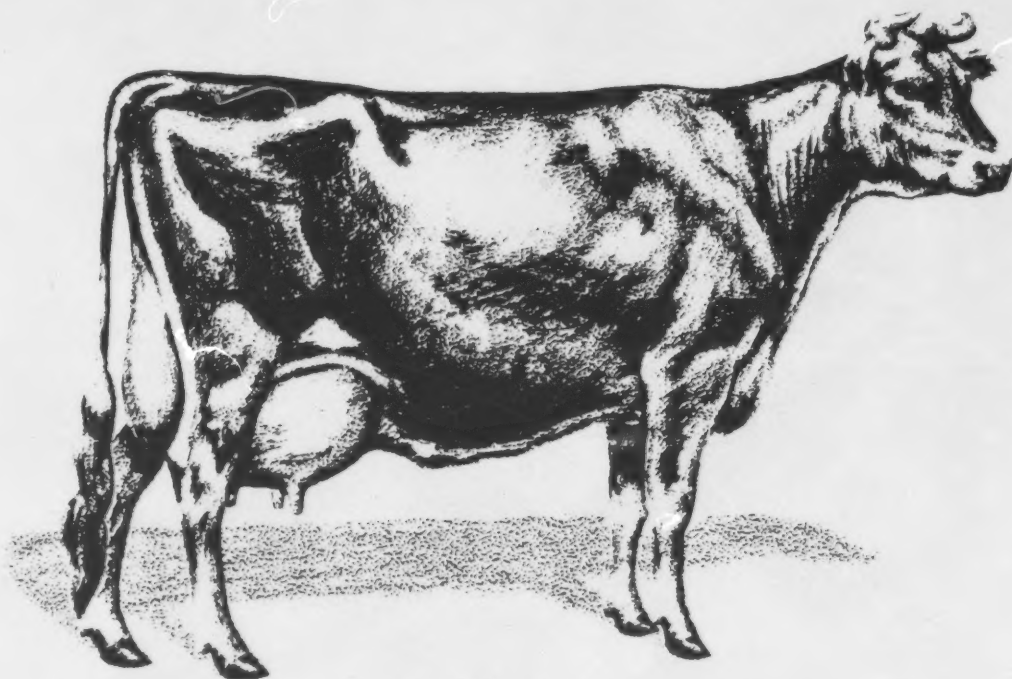
TERMS — MISCELLANEOUS

1. WINGED SHOULDER
2. FRONT LEGS TOE OUT
3. WEAK PASTERNS
4. CRAMPY
5. SMALL FOR AGE

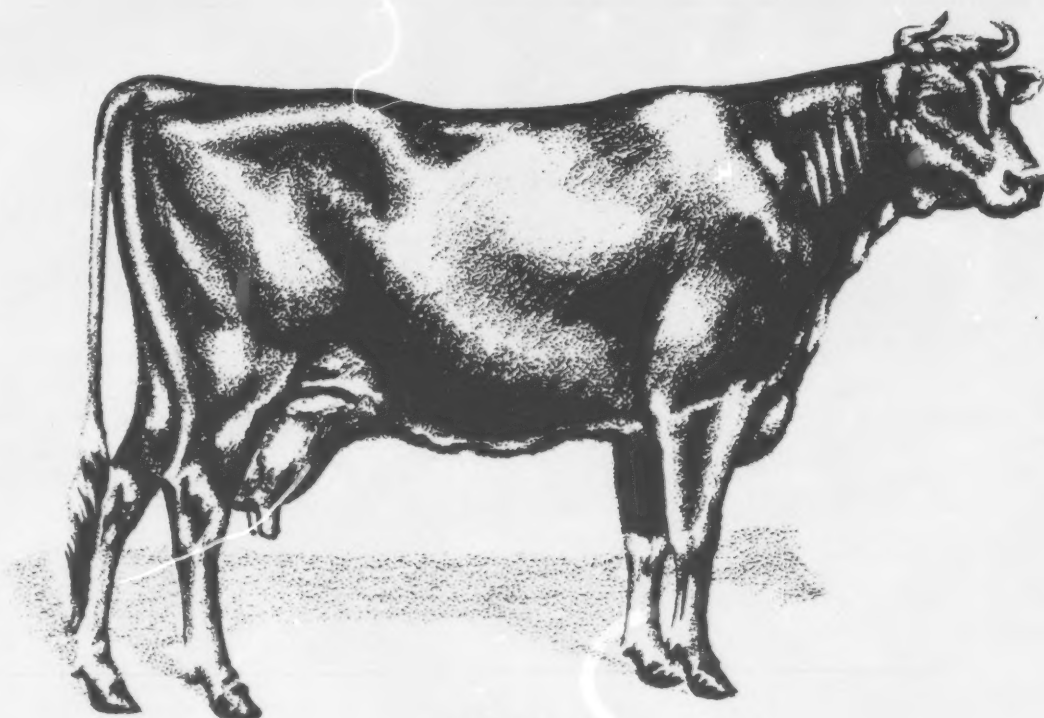
* E (EXCELLENT) 90-100 G (GOOD) 75-79
V (VERY GOOD) 85-89 F (FAIR) 65-74
+ (GOOD PLUS) 80-84 P (POOR) 64&BELOW

CLASSIFIER'S SIGNATURE _____ DATE _____

DAIRY CHARACTER



GOOD



POOR
461

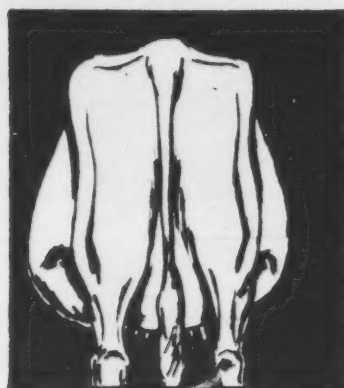
BODY CAPACITY



GOOD



POOR



GOOD



POOR



GOOD



POOR

TM-5

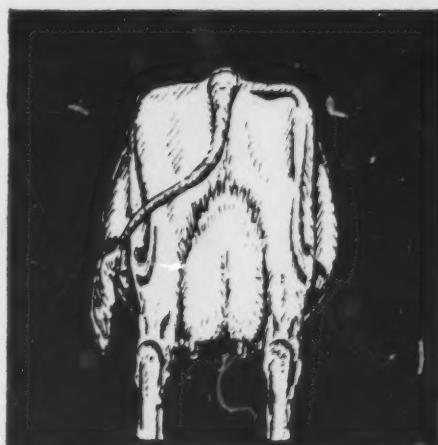
MAMMARY DEVELOPMENT



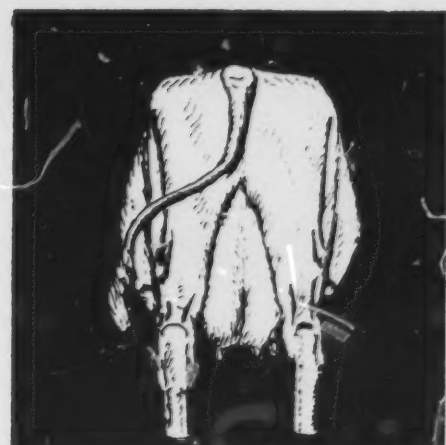
GOOD UDDER AND
FORE UDDER
ATTACHMENT



POOR UDDER AND
FORE UDDER
ATTACHMENT



GOOD UDDER AND
REAR UDDER
ATTACHMENT



POOR UDDER AND
REAR UDDER
ATTACHMENT

DAIRY HERD IMPROVEMENT RECORDS

BARN SHEET--DIII-201

B R E E D I N G T A G N O.	REGIS- TRATION INDEX NO.	COW INDEX NO.	LAST TEST DAY DATA				CURRENT TEST DAY DATA							REPRODUCTIVE STATUS		SIRE OR CALF ID	
			DAILY MILK WEIGHTS LBS.	%B- FAT	DATE		MILKING WTS		%B- FAT	SAMPLE NO.	DATE		CONC. FED LBS.	LAST DATE BRED	DATE DUE		
					MO.	DAY	1ST	2ND			MO.	DAY					
3	64	WAF4203	0002	33.0	3.3	9	25	17.5	18.0	3.5	6	10	25	16	8-18-73	5-28-74	H78

LACTATION RECORDS TO DATE ENTERED HERD

INDEX NUMBER	LAST MONTH		DATE OF			NUMBER DAYS		MILK POUNDS	FAT POUNDS	VALUE PRODUCT	INCOME OVER FEED COST
	DAILY MILK WEIGHTS	%B- FAT	FRESHENING			DRY	IN MILK				
			MO.	DAY	YEAR						
0061	44.3	4.0	12	15	72		215	9,521	503	495.00	250.00

MONTHLY HERD DATA

GROUP	SILAGE	DRY FORAGE	GROUP FED CONC.	PASTURE	CONCENTRATES
	<u>COST</u>	<u>COST</u>	<u>COST</u>		<u>COST</u>
DRY	LBS. CONS. ENE TON	LBS. CONS. ENE TON	LBS. CONS. ENE TON	QUALITY	COST/M
3					
MILK					
2					
MILK		80 \$36.00			\$123.00

DATE OF TEST			BULK TANK WEIGHTS(LBS.)		MILK PRICING INFORMATION					BEGINNING TIME OF MILKING				REPORT FOR MONTH OF
MO.	DAY	YEAR	NO. MILKINGS	TOTAL LBS. OF MILK	NET/CWT.		%B- FAT	B-FAT DIFF.		A. M.		P. M.		
					\$	CENTS		CENTS	10TH	HOUR	MIN.	HOUR	MIN.	
9	25	73			9	82	3.8	0	09	6	15	5	15	SEPT.

SUPERVISOR
NAME

WALKER

494

495

AGI-XI-39

TM-7

CONVERSION FACTORS

(USED TO STANDARDIZE RECORDS)

AGE

(BASED ON AGE WHEN PRODUCTION RECORD WAS BEGUN)

AGE YR., MO.	BROWN				MILKING	
	AYRSHIRE	SWISS	GUERNSEY	HOLSTEIN	JERSEY	SHORTHORN
2-0	1.30	1.45	1.24	1.31	1.27	1.42
3-0	1.18	1.23	1.12	1.18	1.15	1.24
4-0	1.10	1.10	1.06	1.08	1.06	1.13
5-0	1.03	1.04	1.02	1.02	1.02	1.07
6-0	1.00	1.00	1.00	1.00	1.00	1.01
7-0	1.00	1.00	1.00	1.00	1.00	1.00

3X MILKING RECORDS**AGE AT CALVING****FACTORS FOR 3X RECORDS**

2 TO 3 YEARS

.83

3 TO 4 YEARS

.85

4 YEARS AND OVER

.87

LENGTH OF LACTATION

240 DAYS OR LESS

1.15

335 DAYS

.93

315 DAYS

.98

355 DAYS

.89

450

DAIRY CATTLE PEDIGREE

(NAME & REGISTRATION NO.)

CLASSIFIED VG

	#M	%	#F
2 REC. AV.	9775	5.2	508

SIRE
(NAME & REGISTRATION NO.)

CLASSIFIED EX

	#M	%	#F
12 DAUS. AV.	9150	5.2	476
12 DAMS AV.	8800	5.0	440
	+350	+0.2	+36

10 DAUS. CLASSIFIED AV. 84.1

DAM
(NAME & REGISTRATION NO.)

CLASSIFIED GP

	#M	%	#F
3 REC. AV.	9200	5.0	460
2 DAUS. AV.	9100	5.3	482

GRAND SIRE
(NAME & REGISTRATION NO.)

CLASSIFIED VG

	#M	%	#F
10 DAUS. AV.	8500	4.9	417
10 DAUS. CLASSIFIED AV.	84.0		

GRAND DAM
(NAME & REGISTRATION NO.)

CLASSIFIED VG

	#M	%	#F
4 REC. AV.	8900	5.5	489

GRAND SIRE
(NAME & REGISTRATION NO.)

CLASSIFIED GP

	#M	%	#F
15 DAUS. AV.	8750	5.2	446
15 DAMS AV.	8600	4.9	421
	+150	+0.2	+25

GRAND DAM
(NAME & REGISTRATION NO.)

CLASSIFIED VG

	#M	%	#F
2 REC. AV.	9700	5.0	485

NOTE: ALL RECORDS ADJUSTED TO 2X-305 DAYS MATURE EQUIVALENT BASIS.

DAIRY CATTLE PEDIGREE TERMS AND ABBREVIATIONS

1. 2X-305 Days - Milked twice a day for 305 days; the records on most pedigrees are adjusted to 2X-305 days mature equivalent basis.
2. #M - Pounds of milk
3. % - Percent of butterfat
4. REC. - Record(s)
5. #F - Pounds of butterfat
6. AV. - Average
7. DAUS. - Daughters

HERITABILITY ESTIMATES OF DAIRY CATTLE

TRAIT	AVERAGE PERCENT
FAT TEST	50
PROTEIN TEST	50
SIZE	50
BIRTH WT.	45
WEIGHT	35
GESTATION LENGTH	35
FORE AND REAR UDDER	35
GENERAL APPEARANCE	33
TYPE	30
AIRY CHARACTER	30
MILK YIELDS	25
MASTITIS	25
BREED CHARACTER	25
MILKING QUALITY	24
BODY CAPACITY	23
UDDER DEPTH	22
TEATS, VEINS AND QUALITY	20
FEET, LEGS	18
LONGEVITY	10
UDDER SIZE AND SHAPE	7
TEAT LENGTH	5
REPRODUCTIVE PERFORMANCE	3
SERVICE / CONCEPTION	3

STAGES OF MAMMARY GLAND DEVELOPMENT IN THE HEIFER

A



BIRTH TO 1 MONTH
TUBULAR STAGE

B



1 TO 2 MONTHS
ENLARGEMENT STAGE

C



2 TO 3 MONTHS
QUARTER STAGE

D



3 TO 4 MONTHS
QUARTER STAGE

E



4 TO 5 MONTHS
HALF STAGE

F



5 TO 6 MONTHS
HALF STAGE

G

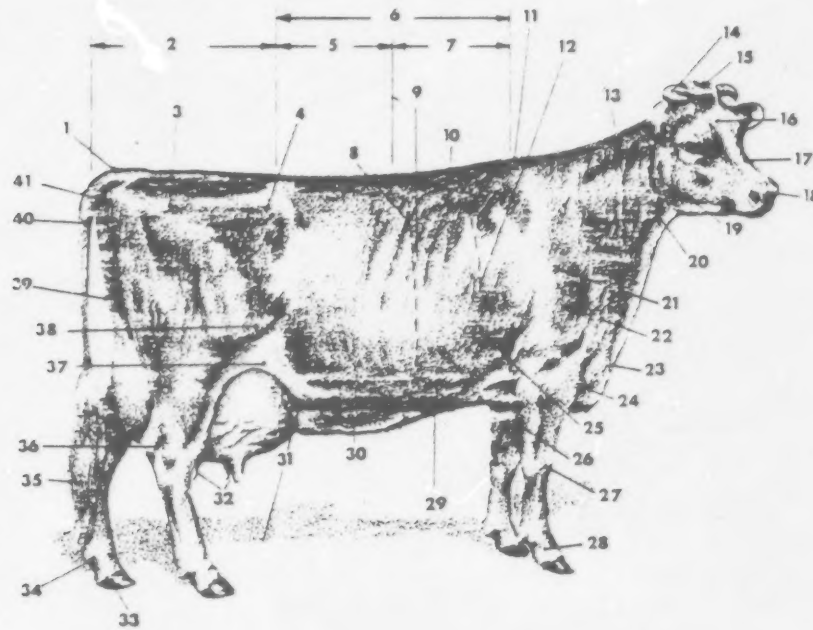


OVER 6 MONTHS
HALF STAGE

SELECTED STUDENT ACTIVITIES

1. What are some factors that should be considered when selecting a breed of dairy cattle?
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
2. What are some factors to consider when selecting individual dairy animals?
 - a.
 - b.
 - c.
 - d.
3. What are the four major areas of the Dairy Cow Unified Scorecard? Record the point emphasis assigned to each of these areas.
 - a.
 - b.
 - c.
 - d.

4. Label the parts of a dairy cow as shown on the illustration below.



- | | |
|-----|-----|
| 1. | 22. |
| 2. | 23. |
| 3. | 24. |
| 4. | 25. |
| 5. | 26. |
| 6. | 27. |
| 7. | 28. |
| 8. | 29. |
| 9. | 30. |
| 10. | 31. |
| 11. | 32. |
| 12. | 33. |
| 13. | 34. |
| 14. | 35. |
| 15. | 36. |
| 16. | 37. |
| 17. | 38. |
| 18. | 39. |
| 19. | 40. |
| 20. | 41. |
| 21. | |

5. Record the classification that would be assigned based on the scores given below.

	<u>SCORE</u>	<u>CLASSIFICATION</u>
a.	92	
b.	83	
c.	79	
d.	85	
e.	78	

6. What are the three types of production records that are sometimes used as a basis for selection of dairy cattle?
- a.
 - b.
 - c.
7. Which one of the production record forms would provide the most complete set of records to use as a basis for selection?
8. What information, in addition to the ancestry of the animal might the pedigree of dairy cattle provide to be used as a basis of selection?
9. Record the approximate heritability of the following inherited traits in dairy cattle.
- a. Size
 - b. General appearance
 - c. Milking ability
 - d. Reproductive performance
 - e. Birth weight
 - f. Fat test
 - g. Dairy character
 - h. Longevity
 - i. Mastitis
 - j. Teats, veins, and quality
10. What information might one seek to determine the general health of the dairy breed?
- a.
 - b.
 - c.
 - d.

Local Adaption --- Animal Science

Poultry and Rabbit Production

Instructor's Guide

1. This unit is for local adaption in animal science. Use this unit if poultry and/or rabbit production are economically important in the agricultural region which your vocational agriculture program serves.
2. This unit contains identification, basic management, and selection information on poultry and rabbits.
3. Sources of additional instructional materials for poultry and/or rabbit production are available from the following sources:
 - (a) Vocational Instructional Services
Texas A & M University
F.E. Box 182
College Station, Texas 77843
 - (b) Vocational Agricultural Services
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801
 - (c) Vocational Education Productions
California Polytechnic State University
San Luis Obispo, CA 93407
4. VEP has excellent slide (or film loop)/tape instructional materials on poultry production and rabbit production. If individualized instruction modes are to be used for selected students, good classroom media are needed and it is suggested that the VEP materials be utilized.
5. Poultry identification, management, and selection will be presented first.
6. Rabbit identification, management, and selection will be presented last.

Poultry Breeds, Classes and Varieties

Instructor's Guide

1. Use these sheets to describe the importance of the difference breeds of poultry and their characteristics.
2. Have students write to the breed association to gather information.
3. Have students report their findings.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds and for poultry selection.
6. Use slide sets of breeds to identify breed traits.
7. Use student materials from Vocational Information Service, Texas A & M, College Station, Texas 77843, or slide/tape materials available from VEP.

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed association.
3. Compare the advantages and disadvantages of the breeds.
4. Select the breeds, classes and varieties most suited to their location and needs and select animals within breeds based on conformation.
5. Understand and be able to use terms common to the poultry industry.
6. Identify major breeds, classes and varieties of poultry.
7. List the physical traits and production characteristics of major breeds, classes and varieties of poultry.
8. Properly manage a poultry enterprise.

References

1. Gillespie, James R., Livestock and Poultry Production, 1981, Delmar.
2. OSU Extension bulletins on Poultry production and 4-H Handbooks.
3. The American Standard of Perfection, The American Poultry Association, Davenport, IA, 1974.

Teaching Aids

1. Overhead project with transparencies.
2. Pictures of breeds, classes and varieties of poultry.
3. Breed Association publications.
4. Slides of poultry breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of poultry.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,283	9,314	8,390
22	Filberts	16,312	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes and plums	5,384	4,784	2,890

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetables & flower seed	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,674
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,335	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermellons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrian peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*

TOTAL GROSS FARM SALES 1,742,337 1,494,437 1,253,984

p - Preliminary r - Revised *Includes nursery crops and turf sod.

SOURCE: Compiled by Extension Economic Information Office, OSU

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
thousand dollars															
THE STATE....	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,683	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,734	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	188,598
Multnomah...	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington...	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Coos.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,651
Tillamook..	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,996	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	687	4,668	17,639	33,406
Jackson....	861	1,175	361	291	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,009	38,735
Josephine..	56	419	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,811	1,315	1,634	9,284	60,074	398,246
Gilliam....	20,227	193	226	108	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Hood River..	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla...	83,314	6,121	794	19,921	12,237	106	12,167	2,700	137,360	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,892	2,442	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,108
Wallowa....	6,244	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes..	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Harney.....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson...	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,880	682	1,960	36,822	83,619
Lake.....	1,431	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

AGI-XII-6

OREGON
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
	thousand dollars								dollars						
THE STATE...	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,494,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,253
Benton....	3,870	306	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas...	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,860	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah...	523	97	117	262	118	3,671	4,962	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,002	1,823	12,443	44,495
Washington...	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop...	---	43	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,886	4,744	6,838
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	5,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,507
Tillamook...	---	74	17	---	---	38	20	1,900	2,044	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas...	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,091
Jackson....	697	708	313	412	16,653	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,536	37,380
Josephine...	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	583	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	181	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River...	---	124	---	---	9,918	82	54	520	40,698	629	524	349	128	1,630	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,637	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	766	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Walla....	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes...	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,986
Jefferson...	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath...	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,196	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

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Glossary of Terms

American Standard of Perfection - a publication of The Poultry Association containing a complete listing and description of all recognized varieties of fowls.

Breed of chickens - chickens that are similar in body shape and form, and that are members of same class.

Broiler - a young chicken eight to ten weeks of age raised for meat production.

Class of chickens - refers to the area where the breed or variety of chicken was developed.

Cockerel - a male fowl less than one year of age.

Comb - the fleshy protuberance growing on top of fowl's head.

Dual-purpose breed - a breed that is recognized for the production of more than one marketable product; thickens for both meat and egg production.

Fryer - a young, immature bird (turkey or chicken) that is tender meat and has soft, pliable, smooth-textured skin and flexible breastbone cartilage.

Hen - mature female chicken or turkey.

Molting - to cast off and renew feathers and skin.

Plumage - the feathers of a fowl.

Poult - young immature turkey.

Pullet - young female chicken under one year of age.

Sexed chickens - chicks that have been separated according to sex at hatching.

Straight-run chickens - chicks of both sexes in the order in which they hatch; chicks hatch in about equal numbers of both sexes.

Strain of chickens - a family name used to designate the breeder.

Turkey hen - a mature, female turkey.

Turkey tom - a mature, male turkey.

Variety of chickens - this is a subdivision of the breed of chickens and is determined by plumage color and the comb.

Name _____

[illegible]

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Classes, Breeds, and Varieties of Poultry

*Terms: All terms underlined are included in "Glossary of Terms."

Note: A set of 2 x 2 slides, "Breeds of Poultry," is available from Vocational Instructional Services, Texas.

CHICKENS

A. History of Chickens

Chickens, which were domesticated some 5,000 years ago, can be found in every county in the world today. Cockfighting, which has been declared unlawful in many countries, is given credit for the spread of chickens throughout the world. Because of their food value and delicious eating qualities, poultry or poultry products are used in most menus.

Charles Darwin, who studies the evolution of animals, believed that the jungle fowl of India were the ancestors of our domesticated chickens; but Darwin wasn't aware of the structural differences, which poultry authorities believe would indicate a different ancestry. The principal difference is the opening through which the spinal cord passes to the brain of the Asiatic varieties and other varieties. Therefore, it is possible that wild chickens were found and domesticated in several areas of the world about the same time. The different habits of some classes would indicate this; for example, the breeds in the Asiatic class prefer to roost on the ground and lay their eggs on a mound of earth. The habits of other breeds indicate that their ancestors roosted in trees.

Three major factors are responsible for the standardbred chickens we have in the U.S. today:

1. Cockfighting is responsible for developing the vigor and vitality of the present day chicken.
2. The delicious edible qualities of chickens are responsible for our general-purpose breeds, which include all of the standardbred chickens in the American class.
3. In the fifty years between 1870 and 1920, the poultry fancier bred for type and beautiful feathers without regard to egg production. These breeders are responsible for our standardbred chickens of excellent type.

In 1873, the American Poultry Association was organized at Buffalo, New York, in order to protect and promote the standardbred poultry industry. The Association publishes the American Standard of Perfection which de-

scribes the varieties, breeds, and classes of poultry. The Standard is issued every five years. New breeds are recognized, and breeds that the Association believes are obsolete are dropped from the Standard. The Association also issues licenses to qualified poultry judges.

B. Importance of Chickens and the Poultry Industry

Today the poultry enterprise is big business in the United States, contributing approximately 8% of the national farm income. The rate of egg production per hen was increased from 152 eggs in 1954 to 224 eggs per year in 1971. In 1980 Oregon's poultry income was as follows: Egg - \$30 million, Broilers - \$27.7 million, Turkey's - \$11.1 million for a total poultry income in Oregon of \$69.5 million. Broiler producers have cut the time to produce a quality broiler from fifteen weeks to nine weeks; and they are producing these broilers on less feed. The number of broilers, not including general farm production of broilers, has increased from 34,030,000 in 1934 to 2,946,916,000 in 1971 in the United States.

C. Classes, Breeds, and Varieties of Chickens

Twelve classes of chickens are listed in the Standard of Perfection. They are the American, Mediterranean, English, Asiatic, Polish, Hamburg, French, Continental, Game and Game Bantam, Oriental, Ornamental Bantam, and miscellaneous classes. Of these, the first four--American, Mediterranean, English, and Asiatic--represent a large percentage of the chickens in the U.S.. These are the classes for which breed characteristics will be given.

A class of chickens refers to the area where the breed or variety was developed; for example, the Mediterranean class is composed of breeds which were supposedly developed in the countries bordering the Mediterranean Sea.

A breed of chickens is the term applied to birds in a class. They are similar in body shape and form. Some of the breeds in the American class are Plymouth Rocks, Wyandottes, Rhode Island Reds, and New Hampshire Reds.

The term variety of chickens refers to a subdivision of a breed. These are largely determined by the color of the plumage and differences in the comb.

A strain of chickens, a family name, denoting the name of the breeder who developed the strain, is a term used to refer to a particular variety.

The Standard of Perfection lists approximately 200 varieties of chickens, but only about a dozen of these varieties have commercail importance in the U.S.. As

the poultry industry has developed, less emphasis has been placed on the classes, breeds, and varieties of chickens.

Several factors must be considered in selecting a breed of chickens. An important consideration is the type of product to be marketed and the markets available. Some breeds are superior in egg production, while others excel in meat production, and some rate well in both areas. The successful poultry product then must follow sound judgment in selecting a breed of chickens that is well suited for his/her enterprise.

The following factors are considered by most poultry producers in selecting a breed or strain:

1. The rate of egg production
2. Mortality rate in the laying house or cage
3. Body size and vigor
4. Egg size and quality
5. Feed conversion

Table 1:

Characteristics of the Common Breeds of Chickens

Classes and Breeds	Weight (lbs.)	Comb Type	Color of Ear lobes	Color of Shanks and Toes	Skin Color	Egg Color	Egg Prod. (High, Med., or Low)	Popularity *Most pop- ular with- in classes
<u>American</u>								
White Plymouth Rock	7½ to 9½	Single	Red	Yellow	Yellow	Brown	Medium	*
New Hampshire	6½ to 8½	Single	Red	Yellow	Yellow	Brown	Medium	
Jersey White Giant	10 to 13	Single	Red	Yellow	Yellow	Brown	Medium	
Rhode Island Red	6½ to 8½	Single and Rose	Red	Yellow	Yellow	Brown	Medium	
Wyandotte	6½ to 8½	Rose	Red	Yellow	Yellow	Brown	Medium	
<u>Asiatic</u>								
Langshan (Black)	7 to 10	Single	Red	Bluish black	White	Brown	Low	*
Cochin	8½ to 11	Single	Red	Yellow	Yellow	Brown	Low	
Brahma (Light)	9 to 11	Pea	Red	Yellow	Yellow	Brown	Low	
<u>English</u>								
Cornish (Dark)	8 to 10	Pea	Red	Yellow	Yellow	Brown	Medium to Low	*
Orpington (Buff and White)	8 to 10	Single	Red	White	White	Brown	Medium	
Australorp	6½ to 8½	Single	Red	Dark Slate	White	Brown	Medium	
<u>Mediterranean</u>								
Leghorn	4½ to 6	Single and Rose	White	Yellow	Yellow	White	High	*
Minorca (White)	6½ to 8	Single	White	White	White	White	Medium to High	
Ancona	4½ to 6	Single and Rose	White	Yellow	Yellow	White	Medium to High	

TURKEYS

A. History of Turkeys

Turkeys, which are one of the few species of poultry native to North America, were domesticated by the Indians in this country and observed by Columbus on his voyage to America in 1492. The early Indians relied extensively upon the turkey for their food.

There are two kinds of wild turkeys, the North American wild turkey and the Ocellated turkey that is native to the Yucatan Peninsula of Mexico. The size of the wild turkey varies from 7 to 9 pounds for the female (hen) and 11 to 13 pounds for the male (tom). Our domesticated turkeys, which originated from the North American wild turkey, weigh from 10 to 30 pounds.

There is only one known breed of turkeys, but there are about fourteen known standardbred varieties within the breed. The most popular varieties are the Broad-breasted Bronze, White Holland, Beltsville Small-Type White, and the Bourbon Red. Approximately 85% of the poults hatched in the U.S. are of the Broad-breasted Bronze variety.

Even though the turkey is a native of the North American Continent, it is regarded as essential for holiday meals in several areas of the world.

B. Importance of the Turkey

11.1 million dollars in gross agricultural income was generated in Oregon in 1980 by the Turkey industry.

The per capita consumption of turkey in the U.S. increased from 3.6 lbs. in 1947 to 8.5 in 1971.

OTHER FOWLS

A. Ducks

The wild mallard duck (*Anas goschas*) is the ancestor of all of the domestic breeds of ducks in the world. It is believed that ducks have been domesticated for a long time since the Romans referred to them more than 2,000 years ago. Commercial duck raising has probably been practiced longer in China than in any other country, but duck raising is practiced extensively in Belgium, Holland, and other parts of Europe. Duck producers emphasize conformation and fleshing qualities.

Duck raising in the U.S. has remained constant, and five states--New York, Michigan, Illinois, Wisconsin, and Massachusetts--produce about half of the nation's ducks. Duck production is concentrated in these states because of the demand for ducks by their foreign population.

Duck breeds are divided into two distinct types, the meat type and the egg type. The most popular breeds in this country are meat type; however, the egg production of some flocks in the European countries exceeds the egg production of our better managed flocks of chickens.

B. Geese

The goose was the first bird to be domesticated and was a sacred bird in Egypt 4 000 years ago. The breeds of geese in the U.S., originated from the wild gray goose. Most of the U.S. geese production is concentrated in the North Central states, where the principal demand is for goslings, which weigh about 12 pounds at 12 weeks of age. There are seven breeds of geese, with the more popular breeds being listed in this topic.

C. Guineas

The guinea, raised in limited quantities in the U.S., originated in Africa where wild guineas exist today. The guinea has been domesticated and spread around the world.

Guinea meat is dark and is substituted by some hotels and restaurants for other game birds. Less than one million guineas are raised in the U.S. annually, with most of the present production being on small farms where they are used as guardians for other poultry. At least disturbance, the guinea will make a harsh cry.

Table 2: Classes and Varieties of Turkeys, Ducks, Geese, and Guineas

Classes and Varieties	Origin	Growth	Weight at 28 weeks	Color of Legs and Toes	Color or Plumage	Egg Production
<u>A. Turkeys</u>						
Broad-breasted bronze	Northwest U.S.	Rapid	Toms--25 to 28 lbs. Hens--15 to 16 lbs.	Dull black with grayish white	Copperish bronze, dull black	Fair
White Holland	Europe	Rapid	Toms--23 to 33 lbs. Hens--14 to 13 lbs.	Pinkish white	White	Good
Beltsville Small-Type	United States	Rapid	Toms--12 to 17 lbs. Hens-- 7 to 10 lbs.	Pinkish white	White	Very good
Bourbon Red (Other standardbred varieties are Narragansett, Black, and Slate.)	Kentucky	Rapid	Toms--23 to 33 lbs. Hens--14 to 18 lbs.	Reddish pink in adults, deep reddish horn in young turkeys	Chestnut ma- hogany; each feather has narrow, black edging.	Fair
<u>B. Ducks</u>						
<u>Egg Breeds</u>			<u>Mature Weight</u>			
Runner (Three Varieties: Fawn and white, White, and Penciled)	East Indies	Fair	4 to 4½ lbs.	Fawn and White: orange- red White: orange Penciled: orange red	Penciled, fawn white	Good
Buff	England	Fair	6 to 8½ lbs.	Orange yellow	Rich, fawn- buff Drake's head and neck seal-brown	Good
<u>Meat Breeds</u>						
Pekin	China	Good	8 to 9 lbs.	Reddish orange	Creamy white	Fair
Cayuga	New York	----	7 to 8 lbs.	Dark slate	Greenish black----	
Aylesbury	England	----	8 to 9 lbs.	Bright, light orange	Pure white	----

Classes and Varieties	Origin	Growth	Mature Weight	Leg and Toe Color	Plumage Color	Egg Production
Rouen	France	-----	8 to 9 lbs.	Dark brown and dusky orange	Mahogany brown, dark brown with greenish sheen	-----
Muscovy	South America	-----	7 to 9 lbs.	Yellow to dark lead	Greenish black	-----
(per year)						
C. Geese						
Toulouse	France	-----	16 to 20 lbs.	Deep, reddish orange	Dark gray on back, light gray on breast, almond white on abdomen	25 to 40
Edmen	Germany	-----	16 to 20 lbs.	Deep orange	Pure white	35 to 50
Chinese (Two varieties: Brown and White)	China	-----	8 to 12 lbs.	Brown: orange White: orange to yellow	Brown: same White: same	40 to 60
African	India	-----	16 to 20 lbs.	Dark orange	Ash brown on back and wings, light ash brown on neck, breast and underside of body	30 to 40
D. Guineaes (Three varieties)	North Africa	-----	2 to 3 lbs.	-----	Purplish-gray, dotted or pearly with white; White; Lavender	-----
White Lavender						

SELECTED STUDENT ACTIVITIES

1. Write the name of the breed of poultry in the space provided for each description given below.

A. Chickens:

- _____ Oldest and most popular of the American breeds
- _____ Developed from the Rhode Island Red
- _____ Most popular of all breeds in the United States
- _____ Largest of the American breeds
- _____ Increasing in popularity due to the broiler crosses
- _____ Recognized most easily by its loose feathering, feathered shanks, yellow skin, and single comb.
- _____ Noted for its lustrous black plumage
- _____ Only the White variety is raised in sufficient numbers to be considered important in the poultry industry
- _____ An English breed that is low-set and heavy-boned
- _____ Largest in size of the Mediterranean breeds
- _____ Resembles the Leghorn in size and conformation but not in color
- _____ Characterized by a pea-comb and massive appearance, weighing from 9½ to 12 pounds.
- _____ Originated in China and imported from England; moderately feathered shanks
- _____ Characterized by bright red plumage and noted as a fancier's breed

B. Turkeys

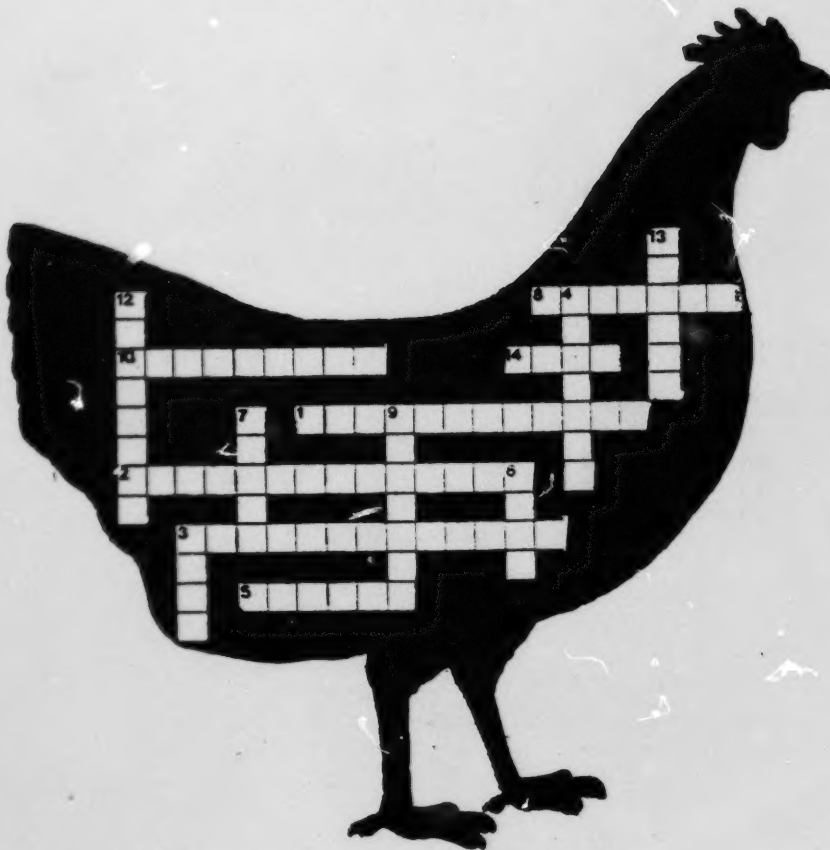
- _____ Pure white plumage color, small size, and developed by the U.S.D.A.
- _____ Dark chestnut mahogany plumage color, with other distinct black and white markings; developed in Kentucky.
- _____ Pure white plumage color, rated in heavy market class, and originating in Europe
- _____ Black plumage color with shades of bronze, copper, red, and green; most popular heavy turkey variety

2. What are some factors that are considered by most poultry-producers when selecting a breed or variety of chickens?

3. List the four classes of chickens discussed in this publication.
 - a. _____ c. _____
 - b. _____ d. _____

4. What is the American Standard of Perfection?

5. Fill in the blank(s) with the most appropriate term(s) relating to breeds and varieties of chickens and turkeys.
 - (a) The Leghorn is the most popular breed in the _____ class.
 - (b) The Cornish has a _____ type comb.
 - (c) The Plymouth Rock is the most popular breed in the _____ class.
 - (d) The New Hampshire lays _____ (color) shelled eggs.
 - (e) The Wyandotte has a _____ type comb.
 - (f) The Minorca has _____ (color) shanks and toes.
 - (g) The breeds considered in the _____ class all have white ear lobes.
 - (h) The highest egg producer according to information presented is the _____ breed.
 - (i) The _____ is the most popular breed in the Asiatic class.
 - (j) The breed considered to be largest in body size is the _____.
 - (k) The breed of chicken which has bluish-black shanks and toes is the _____.
 - (l) The most popular variety of the turkey breeds is _____.
 - (m) Which turkey variety has not been as popular with turkey growers because of the tonnage produced? _____
 - (n) Which of the following turkey varieties is rated higher in fertility: Broad Breasted Bronze or White Holland? _____
 - (o) The _____ turkey variety was developed by the U.S.D.A.
 - (p) The plumage color of the _____ turkey variety is a dark chestnut mahogany.



6. Cross Word Puzzle

ACROSS

1. Oldest American breed
2. Fancier's breed
3. Smallest class
5. Noted for its greenish-black plumage
8. Another name for feathers
10. Decreasing in popularity
14. One of the two food items chickens produce

DOWN

4. Most popular breed in America
6. Chickens that produce both meat and eggs
7. Term describing birds in a class
9. Largest Mediterranean breed
3. One of two food items chickens produce
12. Chickens 8 to 10 weeks old raised for meat production
13. Brought to America from India

THUMB RULES FOR POULTRYFacilities for Laying Hens

	Leghorns	Heavies
Floor space		
Floor pens	1½ to 2 sq. ft.	2½ to 3 sq. ft.
Cages	½ sq. ft.	¾ sq. ft.
Feeder space	3 inches	3 inches
Waterers	5-7 gal. per 100 hens per day	same
Roosts	6 inches lineal spaced 12 inches	8 inches lineal spaced 14 inches

Economic Units: 25 hens for home use
 Farm enterprises no longer applicable
 20,000+ full time for one man, more
 with automation

Feeding

1. 100 hens in light breeds consume 22 to 25 lbs. mash daily.
 Heavy breeds 26 to 28 lbs. of mash daily.
 Annual requirements of concentrates per hen 85 to 100 lbs.
2. Broilers require 2.0 to 2.3 lbs. mash daily.
3. Each 100 baby chicks will consume 100 lbs. of feed the first week, an additional 10 lbs. of feed each week through the 10th week. From 10 to 24 weeks, an additional 5 lbs. per week is required or approximately 25 lbs. of feed from 1 day to 6 months. Broilers are just about doubled except for first week.

General

1. Purchase 1.25 sexed pullet chicks for each good pullet you want to house or 2½ of straight run chicks.
2. Buy leghorn birds for egg production.
3. Buy proven stock - the best is cheapest.
4. Keep a young flock - at least 80-100% pullets.
5. Get ½ eggs from July to January.
6. Brood at least 2/3 replacements from December to April.
7. Buy grain at harvest.
8. Average not over 1 hour per bird per year.
9. Provide 7 to 10 sq. in. per chick under hover. Start temperature at 90 to 95 degrees and reduce 5 degrees for each week to 60 degrees.

10. One hen produces about 140 lbs. of manure per year.
 11. % protein for layers - 15%; for broilers - 20%.
- * Source of information - Dr. Parker, OSU Poultry Dept.

TURKEYS

- I. Feed Requirement
 - A. Fryer-roaster type 2.4 lbs/lb. gain or 20 total lbs. feed
 - B. Market birds 3.0 lbs/lb. gain or 60 total lbs. feed
- II. Space Requirements
 - A. Brooding
 1. Floor
 - a. Poults - 1.00 to 1.25 sq. ft;
under hover 12 sq. ft.
 2. Batteries
 - a. Poults - 25 sq. in./2 wks.
 - B. Rearing
 1. Large tom - 5 sq. ft., hen - 3.0 sq. ft. 8-22 wks.
 2. Small tom - 3.5 sq. ft., hen - 2.0 sq. ft. 8-22 wks.
 - C. Breeders
 1. Floor
 - a. Hens large - 6 to 8 sq. ft.
 - b. Small hens - 5 to 6 sq. ft.
 2. Cages
 - a. Large hens - 2.5 to 3.5 sq. ft.
 - b. Small hens - 1.5 to 2.5 sq. ft.
 - D. Feeder Space
 1. Brooding
 - a. Poults - 1.0 to 2.0 linear in./bird
 2. Rearing
 - a. All birds - 1.0 to 2.0 linear in./bird
or 3 or 4 15" tube feeders/100 birds
 3. Breeders
 - a. All birds - 1.0 to 2.0 linear inch/bird or
4 15" tube feeders/100 birds.
 - E. Water Space
 1. Brooding
 - a. Poults - 0.50 to 0.75 in/bird or two 1-gal.
fount/100 birds
 2. Rearing
 - a. All birds - 0.50 to 0.75 in/bird or two
1-gal. fount/100 birds
 3. Breeders
 - a. All birds - 0.5 to 1.0 in/bird or two
1-gal fount/100 birds

III. Ventilation Requirement

- A. 20 ppm ammonia may damage respiratory tract
50 ppm ammonia is harmful to productivity
- B. Litter moisture levels should be about 25%
Above 30% there is too much ammonia produced
Below 20% dust will develop
- C. About 1 to 1.5 cubic feet/min/lb. body weight

IV. Temperature Requirements

- A. Brooding - 90° to 100° F dependent upon species
and system
Reduce 5°/wk.
- B. Rearing - 45° to 70° F dependent upon light and
dark cycles
- C. Laying - 55° to 75° F optimum

V. General

- A. About 1.5 lbs. manure is excreted/lb. of feed
consumed.

*J.A. Harper Dept. of Poultry Science, OSU

Selection of Poultry

OBJECTIVES

Upon completion of this unit the students will be able to:

1. Determine and describe traits to use in selection of poultry.
2. Explain why type of production is the basis for selection.
3. List the ultimate objective in producing poultry.
4. List factors to be considered by the fryer, stewing chicken, and egg producer.
5. List and describe 5 factors to consider when selecting a breed of poultry.
6. Identify the parts of poultry.
7. List the factors to consider in poultry selection.

Teaching Aids

1. Charts of classes and types of poultry.
2. Transparencies of parts of poultry.
3. Slides, filmstrips, movies, etc.

Student Activities

1. Take a field trip to judge and select poultry.
2. See student materials, "Selecting Poultry."

Glossary of Terms

American Standard of Perfection - a publication of the American Poultry Association containing a complete listing and description of all recognized varieties of fowls.

Breed of chickens - chickens that are similar in body shape and form, and that are members of the same class.

Broiler - a young chicken eight to ten weeks of age raised for meat production.

Class of chickens - refers to the area where the breed or variety of chicken was developed.

Cockerel - a male fowl less than one year of age.

Comb - the fleshy protuberance growing on top of a fowl's head.

Fryer - a young, immature bird (turkey or chicken) that is tender meated and has soft, pliable, smooth-textured skin and flexible breastbone cartilage.

Hen - mature female chicken or turkey.

Molting - to cast off and renew feathers and skin.

Plumage - the feathers of a fowl.

Poult - young immature turkey.

Pullet - young female chicken under one year of age.

Sexed chickens - chicks that have been separated according to sex at hatching.

Straight-run chickens - chicks of both sexes in the order in which they hatch; chicks hatch in about equal numbers of both sexes.

Strain of chickens - a family name used to designate the breeder.

Turkey hen - a mature, female turkey.

Turkey tom - a mature, male turkey.

Variety of chickens - this is a subdivision of the breed of chickens and is determined by plumage color and the comb.

Selecting Poultry

*Terms: All terms underlined are in the "Glossary of Terms."

I. Types of Poultry Producers

Several types of poultry producers, each specializing in one or more areas of production, include commercial egg producers, hatching egg producers (producing broiler chicks and egg producing chicks), broiler producers, and pullet producers.

- A. The commercial egg producer generally sells his/her eggs to a super market, retail store, or customers on his/her own egg route. They strive to increase their net profit by securing maximum production while incurring a minimum of expense. The egg producer may secure replacements by raising straight-run chicks, sexed females, or by purchasing pullets from a hatchery or pullet producer.
- B. The hatching egg producer, producing either hatching eggs for broiler chick or egg production chicks, produces hatching eggs from breeding stock specified by the hatchery. The hatchery designates the breed, strain, or cross that the producer will use to produce the hatching eggs; and generally, the hatchery provides the feed, tests the flock for disease, and assists the producer in making certain management decisions. The percent of hatchability and the quality of hatching eggs usually determines the price per dozen the producer receives for his/her eggs. In order to raise a large number of replacements and to reduce the amount of brooding equipment and housing needed, the hatching egg producer usually purchases sexed females. The hatchery disposes of the cockerels by selling them at a reduced price or by destroying them.

Transparency No. 1

Both the commercial egg and the hatching egg producer must select pullets for their laying houses or cages; therefore, they must be able to recognize profitable pullets with desirable conformation. Since conformation and production are closely related, they must have a mental image of desirable type. To develop this mental image, they should be able to use descriptive terms in describing a chicken. Learning the parts of a chicken will assist the poultry-producer in developing a mental image and the terminology commonly used.

Transparency No. 2

506

Being interested in maximum egg production, the com-

mercial egg producer is interested in those factors pertaining to pullet selection that will affect the pullet's egg production. The following factors should be considered in selecting pullets:

1. Head-The head should show the following characteristics: strong, moderately long, and well filled in forward to the eyes to avoid any appearance of crow headedness, with the skull inclined to be somewhat flat on top rather than round. The face should be clean cut, smooth and free from wrinkles, the skin fine grain and soft in texture, the comb of good substance and size and of good color. The eye should be large, bright, and prominent; the iris should be rich in color and the pupil distinctly and perfectly formed.
2. Sexual Maturity-Sexual maturity should be expressed in the development of comb and head. Early sexual maturity should not be encouraged at the expense of growthiness and ruggedness in skeletal development. Size of development should be preferable to sexual maturity. For example, in poultry judging, a rather small, poorly developed pullet that showed advanced sexual maturity might be placed down second or third in a class of well-developed pullets.
3. Body Conformation- Pullets should have an angular form and the body should be deep, broad, and well-developed. The heart girth should be of ample circumference. The back should be broad and flat with the keel of good length.
4. Plumage Condition and Skin Color-Pullets should be fully feathered with plumage of good quality. The shanks should show a good healthy color with no emphasis on intensity.
5. Feet and Toes-The pullet should be well-balanced on her legs. The feet and toes should be completely normal.

Transparency No. 3

A comparison is used to show the desirable and undesirable characteristics that might be observed in selecting pullets. Any pullet with an abnormality that would affect her egg production should not be selected.

Transparency No. 4

If the flock is a standard-bred variety, the poultry-producer should acquaint him/herself with the disqualifications of the variety listed in the American Standard of Perfection. In addition to the factors considered in selecting pullets, the poultry-producer hatching eggs should consider these factors when selecting replacements for his/her breeding flock:

1. Back-straight, long, and wide
2. Breast-broad, uniform fleshing
3. Legs, Thighs, and Shanks-legs and thighs well-fleshed, legs straight
4. Feet and Toes-well-formed, healthy pads on feet
5. Neck-smooth and blending with body
6. Wings-muscular, closely folded
7. Plumage, Condition, and Vigor-well-feathered, healthy, and vigorous
8. Other Defects-deformed beak, blind eye or distorted pupil, wry or crooked neck, split wing, deformed back, permanent absence of main tail feathers, crooked or malformed keel, crooked toes (90 degree angle) or deformed foot, breast blister on keel, and green shanks.

II. Culling Laying Hens

Culling, which is the opposite from selection, is the removal of inferior or undesirable birds from the laying flock. Culling should be a continuous process and the extent of culling will be determined by the health and quality of the birds, feed and labor costs, and the price of eggs per dozen.

The rate of culling has changed with the improvements in breeding and the development of high egg-producing strains of chickens. After the chickens are placed in the laying house, most poultry authorities recommend that producers cull their flocks at the ninth month of production (15 months of age); this is in addition to the continuous culling recommended to remove unthrifty and unhealthy birds as they are discovered. Hens out of production at this time will not come back into production in time to make the producer a profit. After the ninth month of production, the birds that show pigmentation and poor handling qualities should be culled as they are noticed. High egg-producing strains of chickens that go out of production before the ninth month are not being managed properly. The poultry-producer should correct their unsatisfactory environment, which may include improper feeding, poor sanitation, lighting, inadequate housing, or other factors.

The progressive poultry-producer makes a weekly analysis of production costs. Efficient egg producers are able to produce a dozen eggs on four pounds of feed or less. A simple method of figuring the egg-feed ratio is as follows:

Divide the cost per pound of feed into the price per dozen eggs.

$$\begin{array}{l} \text{Eggs per doz.} \quad 59\text{¢} \\ \text{Feed per lb.} \quad \underline{07\text{¢}} \end{array} = 8.3 - \text{egg-feed ratio}$$

Other expenses connected with egg production are flock

depreciation, labor, and overhead (building, land, etc.). The average depreciation of birds represents approximately 10% of the cost of producing eggs; and labor and overhead represent 15 and 10%, respectively.

Transparency No. 5

In order to cull the laying flock, the poultry-producer must be able to recognize the characteristics of a laying hen. After he/she has learned to recognize these characteristics, culling is not difficult. In the culling process, he/she should follow a definite order of inspecting a hen. The following factors should be considered and are listed in the recommended order of inspection:

- A. Head
 - 1. Comb
 - 2. Wattles
 - 3. Eyes
- B. Body Capacity
 - 1. Back
 - 2. Abdomen
 - a. Pubic bones
 - b. Keel bones
- C. Handling Qualities
 - 1. Body
 - 2. Abdomen
- D. Condition of Vent
- E. Amount of Pigment
 - 1. Vent
 - 2. Eye ring
 - 3. Ear lobes
 - 4. Beak
 - 5. Shanks and toes-Pigment fades in the following order in the shanks and toes:
 - a. Bottom of feet
 - b. Front of shank
 - c. Back of shank
 - d. Hock
- F. Molt
 - 1. Order of body molt
 - 2. Order of wing molt

III. Evaluating Hens for Present and Past Egg Production

Transparency No. 6

With careful study and a little practice anyone can learn to distinguish the laying hen from the non-laying hens and judge the ability of a hen to lay throughout the year based on her past production. Egg laying causes certain changes in the body of a hen that may be used as a reliable guide in culling and in selection.

- A. Fading of the pigment-When a pullet begins to

lay, pigment fades from the various parts in this order: Vent-0 to 5 eggs, eye ring-4 to 8 eggs, ear lobes-(Leghorn only) 8 to 15 eggs, beak-25 to 45 eggs (average 35 eggs), shanks-150 to 250 eggs (average 180 eggs).

Birds will vary in rate of fading depending on the following factors:

1. Body size-small hens fade faster than heavy hens when laying at the same rate.
2. Amount of pigment-The more heavily pigmented at the start, the longer it takes to fade.
3. Health of bird-Sick or low vitality birds may fade due to disease or parasitism.
4. Feed composition-Usually does not affect rate of fading, but it does affect rate of return of pigment after laying ceases.

Pigment returns to the body parts in the same order in which it fades; only it takes about one-third the time for all pigment to return as it took for it to fade. The speed with which pigment returns is governed by:

1. Amount of pigment in the feed-The richer the feed is in pigment, the faster it will return.
2. Health and vitality of hen-The more vigorous hen returns pigment more rapidly than the low vitality hen.
3. Whether hens are confined or on range-Range birds often get more feed with pigment, so yellow color returns faster.
4. Size and coarseness of hen-More refined, smaller birds usually regain pigment at a faster rate.

The melanin or black pigments and the reddish-horn pigments of New Hampshires and Rhode Island Reds do not fade as the result of egg production. Presence of these pigments makes it more difficult to interpret the behavior of the yellow pigment.

- B. Handling quality and abdominal capacity-
The size and condition of the abdominal area are examined in this step. Measurements are in finger widths, such as 2 by 3, 3 by 5, etc. Other factors are: thinness and pliability of the skin, flexibility and spread of the pelvic bones, softness of the abdomen, and freeness from abdominal fat.

Handling quality tells more of present production and less of past production.

- C. Molt or plumage condition-Late molters are usually high producers; slow ones are poor producers. Some high producers may molt and lay at the same time, while others of equally high production may delay molt for a longer period then molt at a more rapid rate. Fast molters take 8 weeks while slow ones may require 16 to 18 weeks to finish the job. Order of molt is: Head, neck, body, primaries, main tail, secondaries. Primaries molt from axil feather (center of wing) outward from 1 to 10 in regular order. Tail feathers molt from the top downward from 1 to 7. Secondaries molt from center of wing in order: 10 to 13, 2 to 9, and 1.

Old feathers are dirty, broken, and frayed. New ones are clean and unbroken. New wing feathers or tail feathers take 6 weeks to grow to maturity, so if hen drops them in groups of 2 to 4, molt can be finished faster.

- D. Constitutional vigor and vitality-Freedom from any signs of disease is active and alert; and will stand up straight and display a high degree of vigor and vitality.
- E. Head characteristics-Beak-short, strong, slightly curved; eye-bright, full, good color; eye ring-refined; skull-flat from side to side, and eye setting in front part of head, and high up near the skull; comb and wattles-large, velvety-soft, and warm.

IV. Selecting Broilers

- A. Selecting broiler breeders-The poultry-producer should consider the same factors when selecting breeding stock for the production of broiler hatching eggs as is outlined for the selection of pullets.

Since most broilers are grown with some type of contractual arrangement, the broiler producer selects the broilers or strain of broilers he/she will produce when he/she selects the firm with which to negotiate a contract.

The contractor generally furnishes the financing, chicks, and plays the role of riskbearer and general manager.

Transparency No. 7

- B. Selecting broilers for market qualities-Official standards for quality of dressed and ready-to-cook poultry have been outlined by the Poultry Branch of the Production and Marketing Administration.

Factors to be considered in determining the quality of an individual carcass are as follows:

1. Body conformation-Influenced by the relative width, length, and depth of the body. It is a major factor in determining dressing percentage and market grade. Desirable conformation includes: wide breasts, carrying the width the entire length of the keel, which is parallel with the back; broad and straight backs; bulging thighs and heavy-meated drumsticks of medium length.
2. Fleshing-Flesh is muscle tissue and has a large influence on the percentage of meat to bone and body conformation. The percent of meat on Grade A broilers is about 29% breast and 32% drumstick and thighs. For turkeys, the breast is about 31% and the drumstick and thighs 27%.
3. Finish-This has reference to fat. Fat of a light-cream or light-yellow color should be evenly distributed over the the entire body. Chickens and turkeys should carry an abundance of fat but not to the extent that they have waste.
4. Pin feathers-Pin feathers are known as protruding and nonprotruding. Protruding pin feathers are those that are out from under the skin and the feather has not matured but may be partially formed. An "A" quality ready-to-cook broiler or turkey must be free of all protruding pins. Nonprotruding pin feathers are those that have not grown enough to come through the skin. An "A" quality ready-to-cook broiler or turkey must be practically free of these pins on the legs and all parts of the body.
5. Defects-One or more defects can reduce the market grade and in most cases are serious enough to cause poultry to be sifted at the show.

Some common defects are:

Curved breastbone	Crooked back
Crooked breastbone	Callouses
Hunch back	Blisters
Torn skin	External parasite
Dented breastbone	blemishes

Requirements for "A" quality broilers and turkeys do not permit cuts or tears on breasts or legs and only a limited amount for "B" quality. Crooked toes are generally considered a defect which lowers the grade.

6. Bruises or skin discolorations-Bruises can be either skin or flesh. They always occur while the chicken is alive-never after it is bled. The flesh bruise is most serious with respect to grade. Skin discolorations may be caused from flesh or skin bruises, hard scalding, external parasites, and/or rough handling.
7. Disjointed bones, broken bones, and/or missing parts-Grade "A" quality permits no broken bones, one disjointed bone, and only wing tip(s) and/or tail missing.

- C. Selecting Turkeys-The contractual arrangement with turkey producers is very similar to that of the broiler producer; however, there are more independent turkey producers (Producers raising turkeys or turkeys for the breeding flock.

The same factors that are considered when buying chicks should be considered when buying broiler turkeys or turkeys for the breeding flock.

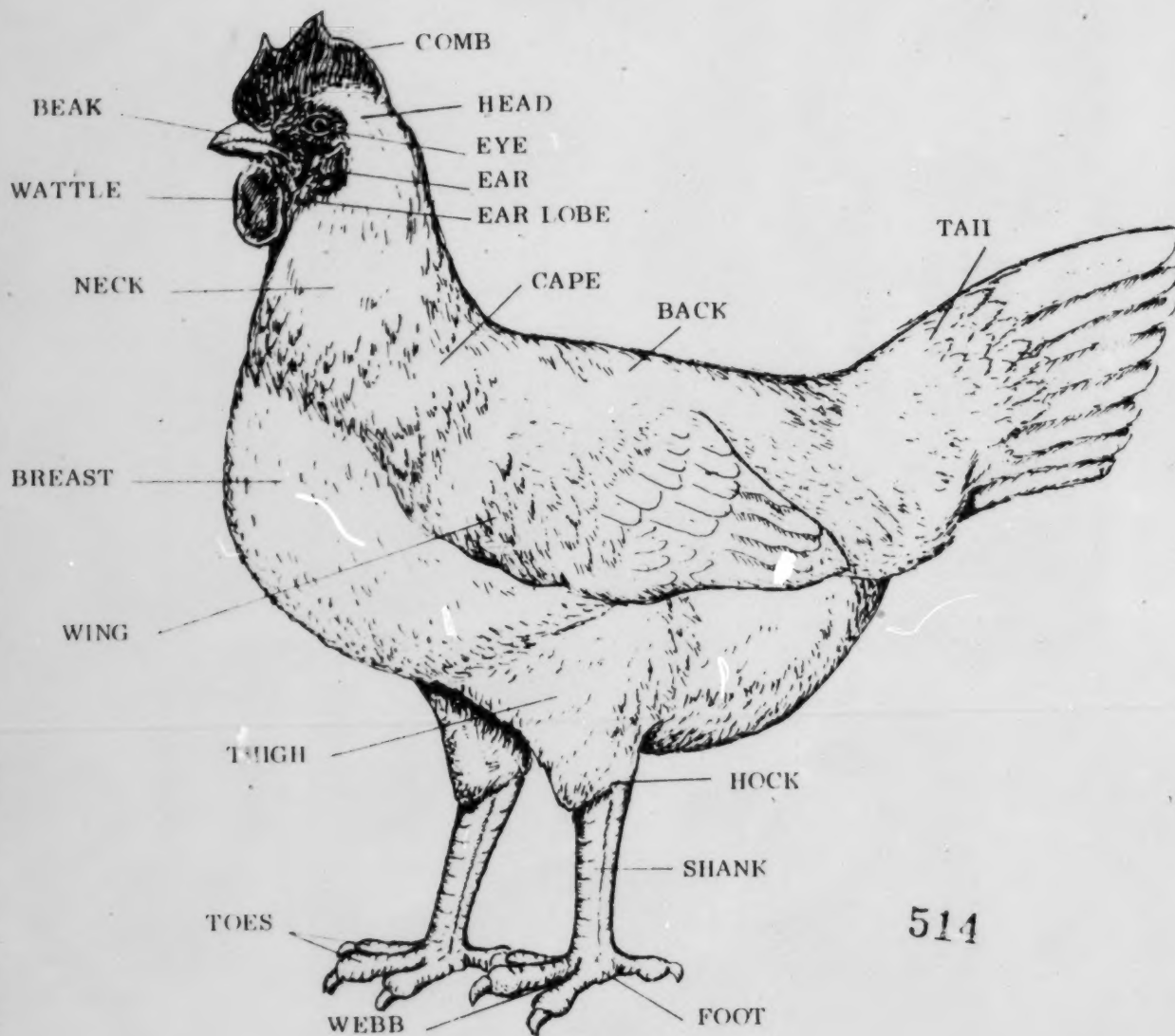
Transparency No. 8

The prospective turkey producer should know the parts of a turkey so that he/she can describe a turkey and converse with others when discussing the selection of turkeys. Common terminology should be used.

Transparency No. 9

Turkey broiler producers and chicken broiler producers are breeding for similar conformation. The same standards that were discussed for grading dressed and ready-to-cook broilers would apply to market turkeys also.

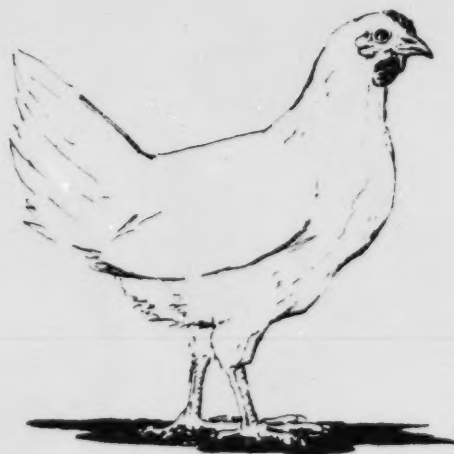
PARTS OF A CHICKEN



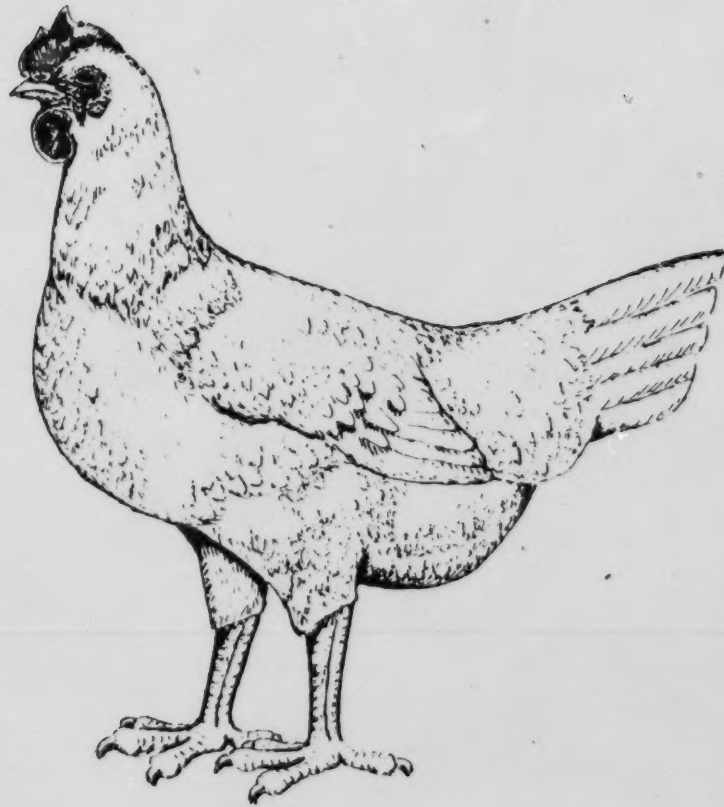
514

FACTORS TO CONSIDER IN SELECTING PULLETS

1. HEAD — STRONG, MODERATELY LONG, & WELL FILLED IN FORWARD TO THE EYES; THE COMB OF GOOD SIZE & SUBSTANCE & RICH IN COLOR; THE EYE SHOULD BE LARGE, BRIGHT, & PROMINENT.
2. SEXUAL MATURITY — WELL DEVELOPED COMB & HEAD; GROWTHINESS & RUGGEDNESS IN SKELETAL DEVELOPMENT AT EARLY AGE IS DESIRABLE.
3. BODY CONFORMATION — DEEP, BROAD, & WELL DEVELOPED WITH A LONG KEEL.
4. PLUMAGE CONDITION & SKIN COLOR — WITH GOOD QUALITY PLUMAGE & SHANKS SHOWING A RICH HEALTHY COLOR.
5. FEET & TOES — NORMAL DEVELOPMENT & WELL BALANCED ON LEGS.

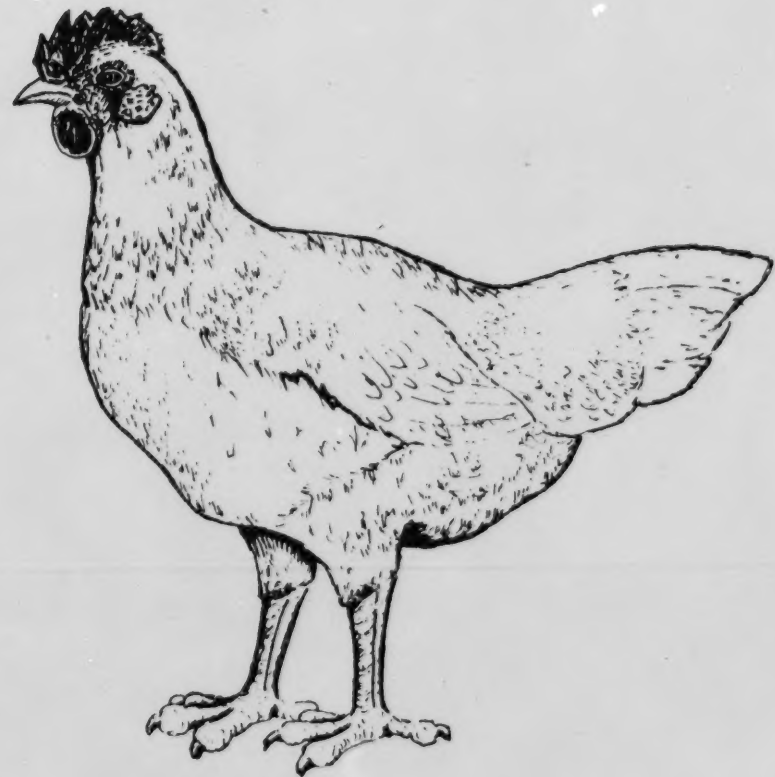


PULLET CONFORMATION



DESIRABLE

516



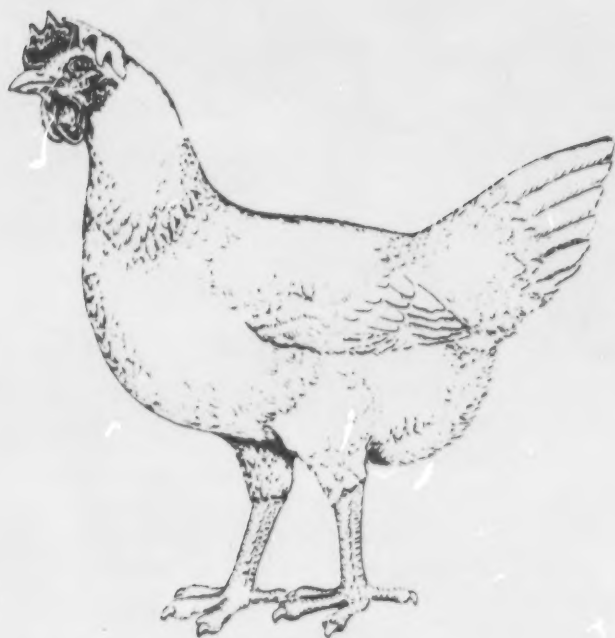
UNDESIRABLE

517

FACTORS TO CONSIDER IN SELECTING FLOCK REPLACEMENTS

- ① BACK - STRAIGHT, LONG, AND WIDE
- ② BREAST - BROAD, UNIFORM FLESHING
- ③ LEGS, THIGHS, AND SHANKS - LEGS AND THIGHS WELL FLESHED; LEGS STRAIGHT
- ④ FEET AND TOES - WELL FORMED, HEALTHY PADS ON FEET
- ⑤ NECK - SMOOTH AND BLENDING WITH BODY
- ⑥ WINGS - MUSCULAR, CLOSELY FOLDED
- ⑦ PLUMAGE, CONDITION, AND VIGOR - WELL FEATHERED, HEALTHY, AND VIGOROUS
- ⑧ OTHER DEFECTS - DEFORMED BEAK, BLIND EYE OR DISTORTED PUPIL, WRY OR CROOKED NECK, SPLIT WING, DEFORMED BACK, PERMANENT ABSENCE OF MAIN TAIL FEATHERS, CROOKED OR MALFORMED KEEL, CROOKED TOES (90° DEGREE ANGLE) OR DEFORMED FOOT, BREAST BLISTER ON KEEL, AND GREEN SHANKS.

LAYER CONFORMATION



LAYER

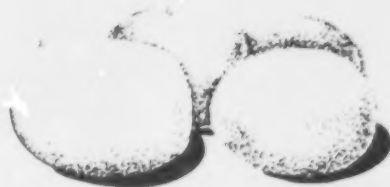


NON LAYER



EVALUATING HENS FOR RATE OF EGG PRODUCTION PAST AND PRESENT

1. PIGMENTATION — FADES AND RETURNS IN ORDER OF VENT, EYE RING , AND EAR LOBE (MEDITERRANEAN CLASS ONLY). ALSO BEAK, SHANKS, FEET, AND TOES.
2. HANDLING QUALITIES — WIDTH, DEPTH, AND PLIABLENESS OF ABDOMINAL SECTION; FLEXIBILITY AND SPREAD OF PELVIC BONES; AND ENLARGEMENT AND MOISTNESS OF VENT .
3. PLUMAGE CONDITION — PRESENCE OF MOLT CONDITION; ORDER OF MOLT - HEAD, NECK, BODY, WING, AND TAIL; FRAYED, WORN, OR SOILED PLUMAGE.
4. CONSTITUTIONAL VIGOR & VITALITY — FREEDOM FROM DISEASE, ACTIVE AND ALERT, STANDS ERECT AND DISPLAYS A HIGH DEGREE OF VIGOR AND VITALITY.
5. HEAD CHARACTERISTICS BROAD, DEEP, AND REFINED; COMB AND WATTLES - LARGE, PROMINENT, AND WAXY RED; EYES - BRIGHT AND ALERT



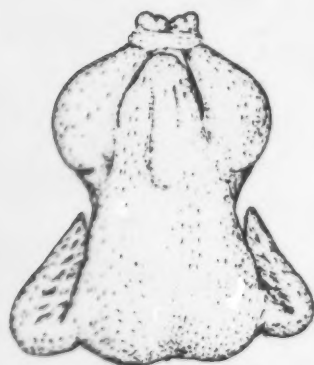
BROILER CONFORMATION



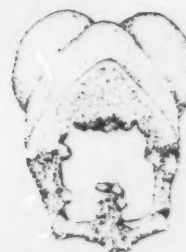
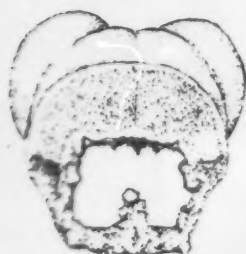
DESIRABLE



UNDESIRABLE

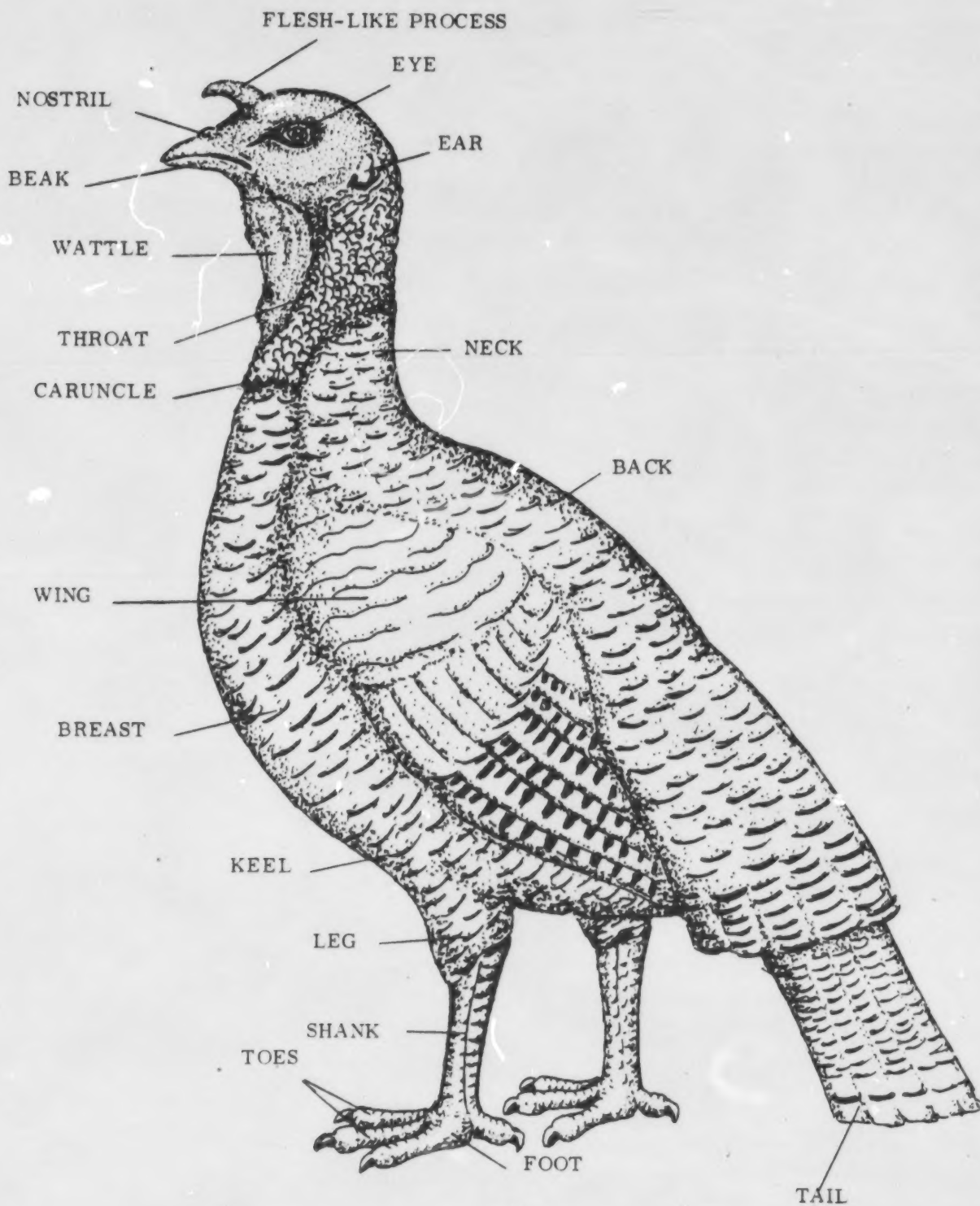


DRESSED CARCASS

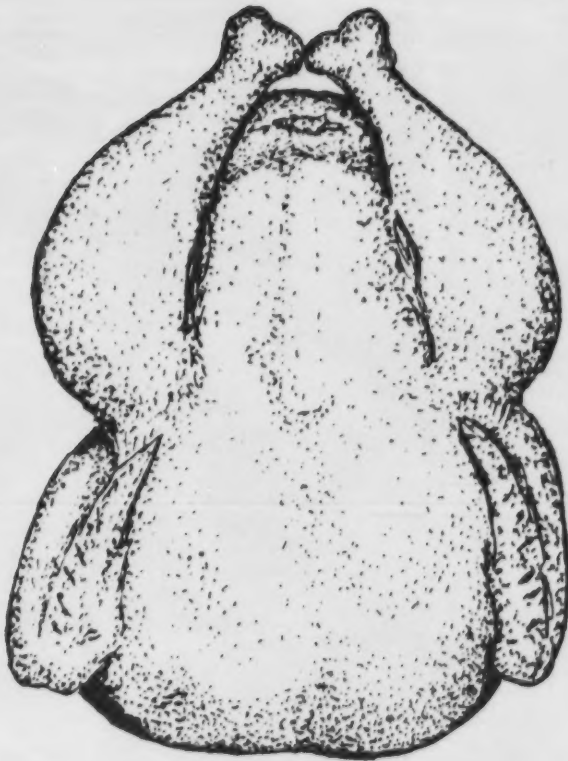


CROSS SECTION OF BREAST

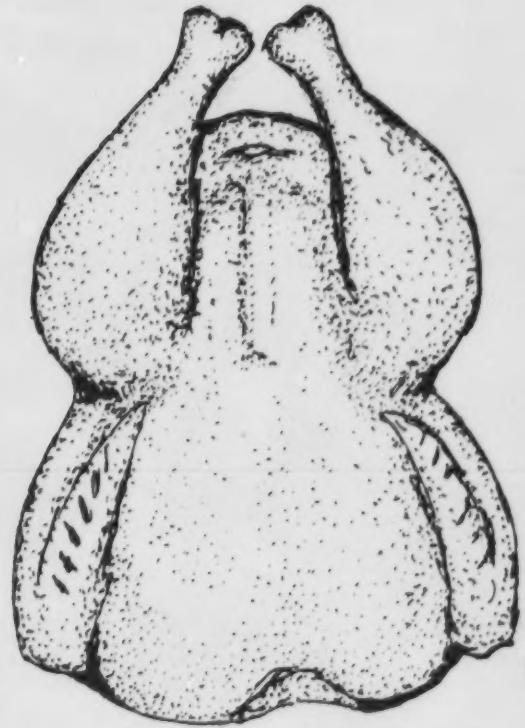
PARTS OF A TURKEY



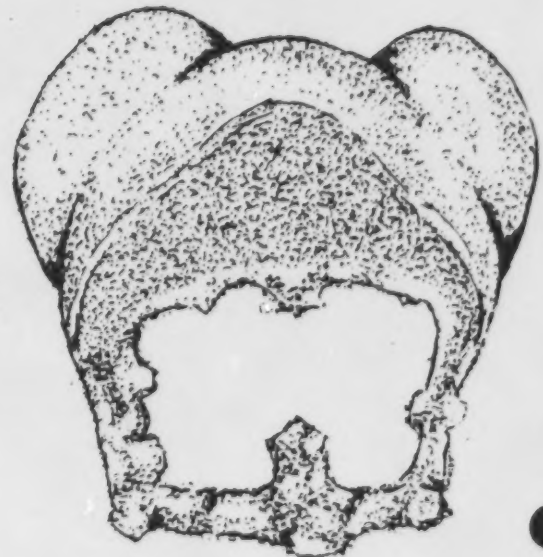
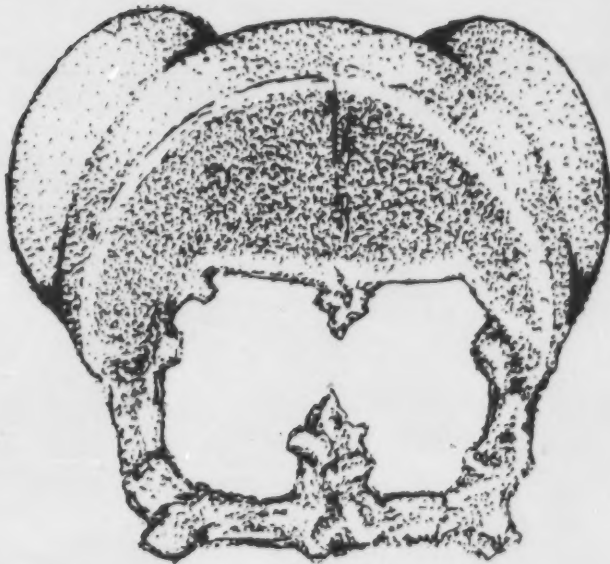
TURKEY CONFORMATION



DESIRABLE



UNDESIRABLE



CROSS SECTION OF BREAST

SELECTED STUDENT ACTIVITIES

1. List the types of specialized poultry producers mentioned in this topic in the areas of chicken production and turkey production.

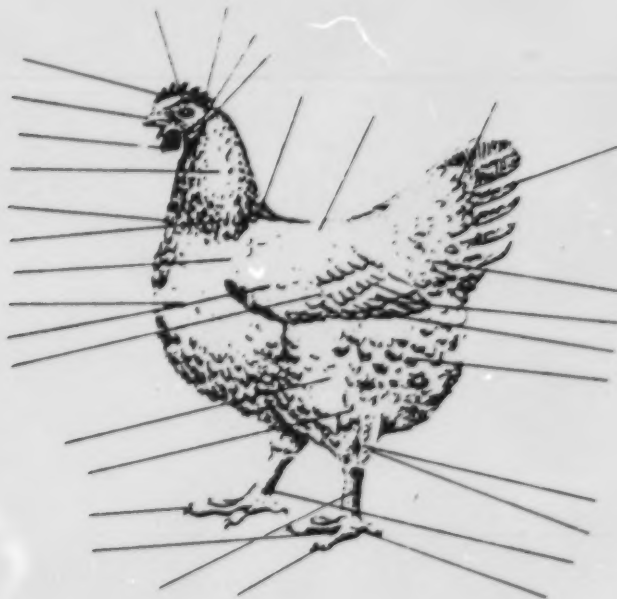
Chicken

- a.
b.
c.
d.
e.

Turkey

- a.
b.
c.

2. Identify the parts of a chicken on the illustration provided by writing the numbers of each part at the proper location on the diagram.



- | | | |
|-----------------|-------------------|-----------------------------|
| 1. Beak | 12. Neck plumage | 23. Tail coverts |
| 2. Comb | 13. Neck feathers | 24. Main tail feathers |
| 3. Wattle | 14. Cape | 25. Cushion |
| 4. Head | 15. Back | 26. Secondaries or wing bay |
| 5. Eye | 16. Breast | 27. Primaries |
| 6. Ear | 17. Wing front | 28. Rear body feathers |
| 7. Ear lobe | 18. Wing bow | 29. Thigh |
| 8. Neck | 19. Wing coverts | 30. Lower thigh plumage |
| 9. Hock plumage | 20. Spur | 31. Toenails |
| 10. Hock | 21. Foot | 32. Web |
| 11. Shank | 22. Toes | |

3. What are the four methods suggested for selecting pullets for egg production?

- a.
b.

- c.
d.

4. Distinguish between the terms "selecting" and "culling".

5. List the conformation factors suggested for consideration in selecting pullets for egg production.
 - a. d.
 - b. e.
 - c.

6. What is the order of inspection suggested for use in the culling process?
 - a. d.
 - b. e.
 - c.

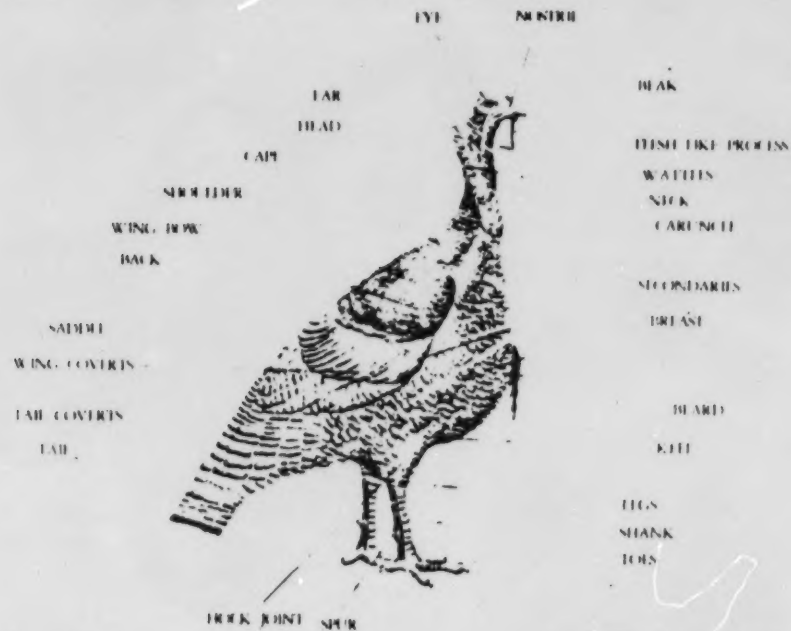
7. List the recognizable changes occurring in the body of a hen that may be used as reliable guides in culling and selecting laying hens.
 - a. d.
 - b. e.
 - c.

8. What are the factors to consider in determining the market quality of a broiler carcass?
 - a. e.
 - b. f.
 - c. g.
 - d.

9. List the points of selection that should be applied in selecting turkeys based on conformation. Give a descriptive statement for each point.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.

10. What are the four reproductive traits that should be carefully considered when selecting breeding turkeys?
 - a.
 - b.

11. Identify the parts of a turkey on the illustration provided by writing the number of each part at the proper location on the diagram.



- | | |
|-----------------------|------------------|
| 1. Ear | 9. Hock joint |
| 2. Nostril | 10. Spur |
| 3. Flesh-like process | 11. Saddle |
| 4. Wattle | 12. Cape |
| 5. Caruncle | 13. Wing bow |
| 6. Beard | 14. Skirts |
| 7. Keel | 15. Wing coverts |
| 8. Secondaries | |

12. List some defects that should be observed when selecting turkeys for show purposes.

- | | |
|----|----|
| a. | e. |
| b. | f. |
| c. | g. |
| d. | |

RABBITSInstructor's Guide

1. The following unit is a copy of a unit available from Illinois, Vocational Agricultural Service, College of Agriculture, University of Illinois, Urbana. The cost is minimal, approximately \$0.25 per copy. You may want to use it as a teaching outline or for a student reference. The catalogue number is 1050.
2. You could take students on a field trip to see local rabbit producers.
3. This unit is intended as a 2-3 day unit; however, you may want to either leave it out or go into much more depth, depending on your area.
4. An excellent film-loop is available from VEP, address noted at introduction to the Poultry and Rabbit production unit.

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Choose a breed of rabbits which suits their goals.
2. List and explain proper use of equipment pertaining to rabbits.
3. Properly feed rabbits.
4. Properly care for doe at breeding and gestation.
5. Properly care for doe and litter during kindling and lactation.
6. Prevent injuries and diseases in rabbits.
7. Select appropriate breed for their production selection, and select individual animals based on conformation.

References

1. Gillespie, James R., Modern Livestock and Poultry Production, 1981, Delmar
2. OSU 4-H materials
3. VEP film-loop, Rabbit Production
4. Vocational Agricultural Service, Rabbit Raising.

Teaching Aids

1. Student materials from Illinois.
2. Rabbits (different breeds).
3. Proper equipment for rabbit production.

Student Activities

1. Field trip to see rabbits and production.
2. Have students give oral reports.

Glossary of Terms

Buck - a male rabbit.

Crossbred - an animal resulting from the mating of two different breeds.

Doe (rabbit) - a female rabbit.

Gestation period - the period between breeding of the female and birth of the offspring.

Get - the offspring of an animal, usually the sire.

Kindle - the act of a rabbit giving birth to young.

Parturition - the act of giving birth to young, applies to all animals.

Utility - usefulness.

I. Introduction

Americans eat 25 to 30 million pounds of domestic rabbit meat each year. The rabbits come from small rabbitries with three or four hutches and from large commercial producers. Rabbit raising lends itself to both types of production. Rabbit meat is pearly white, fine-grained, palatable, and nutritious. It is a convenient source of high-quality protein and is low in fat and caloric content.

Rabbit skins also have some commercial value. Better grades of rabbit skins may be dressed, dyed, sheared, and made into fur garments and trimmings. Some skins are used for slipper and glove linings, for toys, and in making felt. Because of the relatively low value of skins from meat rabbits, a large volume is necessary to market them satisfactorily.

There is also a demand for rabbits for laboratory and biological purposes for breeders living near medical schools, hospitals, and laboratories. Rabbits have made large contributions to research in venereal disease, cardiac surgery, hypertension, and virology, and are important tools in pregnancy diagnosis, infectious disease research, the development of hyperimmune sera, development of toxins and antitoxins, and the teaching of anatomy and physiology. A recent development in the rabbit industry has been the increased use by scientific personnel of various rabbit organs and tissues in specialized research.

II. CHOOSING A BREED

Whether you raise rabbits for meat and fur, wool, laboratory animals, or show stock--select the breeds best adapted to the purpose.

The American Rabbit Breeders Association lists standards for 28 different breeds, and approximately 77 varieties of these breeds, to cover characteristics, such as type, color, and size; disqualifications also are listed. Table 1 lists some common breeds of rabbits.

Mature animals of the smaller breeds weigh 3 to 4 pounds each; those of the medium breeds, 9 to 12 pounds; and those of the larger breeds 14 to 16 pounds. They also vary widely in color.

Rabbits best suited in size and conformation for producing meat and fur are such medium and large breeds as the New Zealand, Californian, Champagne d'Argent, Chinchilla and Flemish Giant. White breeds of rabbits, such as the New Zealand White and Californian, are the most desirable for commercial and fur production because white skins usually bring higher prices. Preference among the white breeds is largely a matter of personal choice. Skins are a byproduct of meat production.

If you raise rabbits for laboratory purposes, check with nearby hospitals, laboratories, and city and county health offices to find out the type, age, and size of animals desired.

Table 1. Some common breeds of rabbits

Breed	Color	Approximate mature weight	Principal uses
		<u>POUNDS</u>	
American Chinchilla	Resembles the true chinchilla, (Chinchilla laniger).	9--12	Show and fir
Californian	White body; colored nose, ears, feet, and tail.	8--10½	Show and meat
Champagne d'Argent	Undercolor a dark slate blue; surface color a blue-white or silver with a liberal sprinkling of long black guard hairs.	9--12	Show and meat
Checkered Giant	White with black spots on cheek, sides of body, and on hind-quarters; wide spine stripe; black ears and nose with black circles around the eye.	11 or over	Show and fir
Dutch	Black, blue, chocolate, tortoise, steel gray, and gray; white saddle, or band over the shoulder carrying down under the neck and over the front legs and hind feet.	3½--5½	Show and laboratory
English Spot	Basic body color white; colors of spots: black, blue, chocolate, tortoise, steel gray, lilac, and gray; nose, ears, and eye circles and cheek spots; spine stripe from base of ears to end of tail; side spots from base of ears to middle of hindquarter.	5--8	Show, meat, and laboratory
Flemish Giant	Steel gray, light gray, sandy black, blue, white, and fawn. No two colors allowed on solids.	13 or over	Show and meat
Himalayan	Same as Californian	2½--5	Show and meat
New Zealand	White, red, or black	9--12	Show, meat, and laboratory
Polish	White, black, or chocolate; ruby-red eyes or blue eyes.	3½	Show and laboratory
Rex	Representative of any breed	7 or over	Show and fur
Satins	Black, blue, Havana brown, red, chinchilla, copper, Californian, and white	8--11	Show and fur
Silver Martens	Black, blue, chocolate, or sable, with silver-tipped guard hairs.	6½--9½	Show and fur

III. WHAT EQUIPMENT DO I NEED?

Select rabbitry equipment that is adapted to your local conditions and to your proposed operations by reviewing the literature on the subject. If possible, visit rabbitries and discuss problems with successful breeders. Have your equipment ready when the first rabbits arrive.

Buildings

Buildings are usually not necessary in the milder climate of the midwest. If you desire a building, or live in a cold climate, the type will be determined by local building regulations, climatic conditions, and the amount of money you can invest. In planning your building and its equipment, emphasize comfort of the rabbits and convenience of the caretaker. The building should have a simple design, protect the rabbits from winds, rain, and bright sun, and provide light and fresh air. In mild climates, hutches may be placed in the open but should have individual roofs and protection from the weather.

Sunlight helps maintain a sanitary condition in the rabbitry but whether it actually helps the rabbits themselves has not been determined. Rabbits apparently enjoy being in the sun where temperatures are low or moderate but it is not necessary that they receive direct sunlight. In fact, exposure to direct hot sun may have serious deleterious effects on rabbits.

In mild climates, hutches may be placed in the shade of trees or buildings or under a lath superstructure.

In hot climates, some cooling measures must be provided in addition to shade. This can be accomplished by the use of overhead sprinklers, or foggers placed within the building. Make sure that the building is adequately ventilated and that the rabbits receive the benefit of prevailing breezes. In areas where strong winds and stormy weather prevail, you can put up hutches in a building that is open to the south and east; use curtains or panels to close up the building during inclement weather. Where you have extremely cold weather, more protection will be needed.

Hutches

Provide individual hutches for mature rabbits. The hutches should be no more than 2½ feet deep so you can easily reach the rabbits. Make the hutches 3 feet long for small breeds, 3 or 4 feet for medium-size breeds, and 4 to 6 feet for giant breeds, and about 2 feet high. All figures are for inside measurement. Whether you arrange the hutches in single, double, or triple tiers depends upon the amount of room that is available. If you have enough room, waist-high, single-tier hutches are preferable as they are most convenient for observing the rabbits and will also save time and labor in feeding and management.

The two-or three-tier hutches, necessary when space is limited, are not entirely satisfactory for caring for and observing the animals in the bottom and top tiers. The inconvenience of squatting or stooping to feed and care for rabbits in the bottom tier and of having to use a stool or ladder for the top row of a three-tier arrangement results in additional labor and time as compared to a single-tier arrangement.

Rabbits are more easily cared for in well-built hutches than in poorly constructed temporary ones. Self-cleaning, all-wire hutches need no bedding and you can easily keep them in good condition.

Metal hutches. Several designs for all-wire hutches are available commercially or you can build your own. Plans and specifications may be obtained from commercial firms who advertise in the various rabbit journals.

Wooden-frame wire hutches. Though not so durable as the all-wire hutch, the wooden hutch with wire-mesh or hardware-cloth sides and ends permits good circulation of air. It is more sanitary than a solid hutch.

Hutches may be supported in several ways. Usually the hutches are built on legs, with the bottom and top supported on the legs. If you use corner posts, make them long enough so that you can clean underneath and do other work around the hutch. If you are building the hutch in a shed, you can support it on a crosspiece nailed between the studs, or hang it from the rafters or ceiling with heavy wire or light lumber.

Semienclosed hutches. The semienclosed hutch is constructed with ends and back of wood. An extended roof gives added protection. You can use this hutch in outdoor rabbitries in cold climates.

Rabbits kept in hutches made of wooden frames and wire need additional protection in cold climates.

Hutch floors. Several types of floors are used in hutches, and each has its particular merit.

Wire-mesh floors are used extensively where a self-cleaning type is desired. They are a necessity in commercial herds, where it would be impossible to provide enough labor to keep solid floors in a sanitary condition. In installing this type of floor, examine the wire for any sharp points. Always put the smooth surface on top. Solid floors should slope slightly from the front of the hutch to the rear to provide proper drainage. You can use hardwood slats, 1-inch wide and spaced 5/8-inch or 3/4-inch apart. A combination of solid floor at the front part of the hutch and a strip of mesh wire or slats at the back may be used.

Feeding equipment

It is desirable to use feed crocks, troughs, hoppers, and hay mangers that are large enough to hold several feedings, to save time in filling. Use a type that will prevent waste and contamination of the feed.

Crocks. Crocks especially designed for rabbit feeding, which are not easily tipped over have a lip that prevents the animals from scratching out and wasting their feed. The chief objection to these is that the young rabbits get into them and contaminate the feed.

Hay mangers and troughs. Hay mangers with troughs to prevent wastage may be made into the hutches, where hays or green feeds form a part of the diet. The troughs also can be used for supplemental grains or home-grown feeds. The troughs may be constructed so that they can be pulled out of the hutch for cleaning, filling, and disinfecting. Guards placed on the feed troughs and spaced just far enough apart to allow mature animals to feed, will help keep young rabbits out of the troughs and from contaminating the feed.

Hoppers. Feed hoppers of the proper design and size save considerable time and labor. These can be constructed from metal, wood, masonite, or other readily available materials. They should hold several days' supply of feed and be placed within the hutch or suspended on the outside. The opening through which the rabbits eat the feed should be not more than 4 inches above the hutch floor so that the young rabbits can reach the feed.

You can save hutch floor space by using a hopper with a feed opening on one side only and by placing the hopper only part way into the hutch. Cut an opening large enough to accommodate the hopper in the side of the hutch. Then, wire the top of the hopper to the hutch for support. One short baffle on the side opposite the hopper opening will keep feed out of the rear corners.

A one-compartment feed hopper is used when only one kind of feed is given. When mixed feed that the rabbits can separate is offered in the hopper, the feed will be selectively consumed. The rabbits scratch out and waste the part they prefer not to eat. You can prevent this waste by using a hopper with individual compartments for each feed.

Equipment for watering

Rabbits should have clean, fresh water at all times.

Crocks. Half-gallon water crocks are still used rather extensively. Fasten them in the hutches so that the rabbits will not tip them over. If a part of the crock extends through the front wall of the hutch, you can refill it without opening the hutch door. Clean and disinfect the crocks periodically.

Coffee cans are especially useful for watering rabbits during cold weather because you can easily break and remove the ice. Cans are, however, easily tipped over unless you fasten them to a board.

Automatic watering systems are usually too expensive for the back-yard producer but are widely used in commercial rabbitries. Conventional systems sold by rabbit and poultry supply houses consist of a pressure-reducing tank equipped with a float valve, a $\frac{1}{2}$ -inch supply pipe, a watering unit for

each hutch, and valves. The valves, with the right amount of pressure on them, will have a drop of water hanging on it but will not drip. As the rabbit sucks that drop off, another one appears, until the rabbit has had a drink.

Nest boxes

No one type of nest box is best suited for all conditions, but all should provide seclusion for the doe at kindling and comfort and protection for the young. Nest boxes should be large enough to prevent crowding and small enough to keep the young together. All types should provide good drainage and proper ventilation. Two general kinds have been used extensively--the box type and the nail-keg type. If a nail keg is used, nail a 1-by 6-inch board across the open end of the keg, so that it covers one-third to one-half of the opening. To keep the keg from rolling, extend the board a few inches beyond the sides of the opening. Drill several 1-inch holes in the closed end of the keg for ventilation, and some 1/4-inch holes in the bottom for drainage.

Since nail kegs have become difficult to obtain, apple and pear boxes are frequently used. These may be fitted with tops or left open. In either event, a portion of one end should be removed to provide easy access for the doe and young.

Metal nest boxes also are available but have the disadvantage, in some climates, of being cold or collecting condensation of water vapor.

To help keep the nest dry, cut some 1/4-inch drain holes on the bottom of the nest-box drawer.

Losses of young rabbits kindled in winter can be largely prevented if you furnish proper nesting accommodations. If a doe reacts normally to her newborn litter by pulling enough fur to make a warm nest and feeding her young, and if the nest box is well insulated, the young can survive temperatures as low as 15° and 20° below zero.

You can make a good type of winter nest box by placing a standard size nest box inside a larger box. Pack straw into the space of 3 inches or so on all sides except entrance and top. A lid of ordinary box wood covered on the under side with two thicknesses of paper will supply the necessary top insulation. Make two or three holes, 1 - 3/4-inch in diameter, in the lid at the end opposite the opening to the nest box, for ventilation and to prevent condensation within the nest box. On the bottom of the inner box, put one or two layers of corrugated cardboard or several thicknesses of paper to keep the newborn litter from coming in contact with the cold boards. Fill the nest box so completely with new, clean straw that the doe will have to burrow into it to form a cavity for a nest. Inspect the box daily for the first 3 or 4 days. If the cardboard or paper becomes damp from accumulated moisture, remove it promptly. Replace it if cold weather continues. A simpler nest box for use in winter consists of a single box lined completely with one or two layers of

corrugated cardboard and filled with straw.

IV. HOW SHOULD I FEED THE RABBITS?

It is possible to balance a ration for rabbits just like for other farm animals. This would start with the home-grown grains, either whole or as milled products and adding a protein supplement and such green feeds as were available. Most feeds and feeding books would give the nutrient content of the various feeds and also the daily nutrient requirements for the rabbits. With these two bits of information, it is no problem to balance the ration.

The average producer, however, would rather purchase commercially prepared rations in pelleted form than to mix their own. These may be one of two types--the all-grain pellet to be fed with hay and the complete (green) pellet. The complete pellet contains all the food elements necessary for a balanced diet, except salt.

Pellets should be 1/8-to 3/16-inch in diameter and 1/8-to 1/4-inch long. If pellets are too large, small rabbits cannot get them in their mouths. The rabbits bite off a part of the pellet and drop the rest. The discarded part is lost through the wire hutch floor or is left to become contaminated on solid floors.

Hay

If you are feeding an all-grain pellet, you will need to furnish hay free-choice. Choose a good, legume hay that is fine stemmed, leafy, green, well cured, and free from mildew or mold.

If you feed whole, coarse hay, quite a bit of it will be wasted. The rabbits will pull a stem out of the hay manger, eat part of it, and drop the rest. To prevent some of this waste and to put the hay in a more convenient form for feeding, cut it into 3-or 4-inch lengths.

The legume hays, best suited for rabbits, are alfalfa, clover, lespedeza, cowpea, vetch, kidzu, and peanut, are palatable and make good feed for rabbits. The grass hays are not as palatable and lower in protein than the legumes hays. If legumes are not available or if you must feed grass hays, more protein supplement will need to be added to the diet.

Salt

Salt is necessary in the diet. Put small blocks or salt spools in the hutch so the animals can feed at will, or add 0.5 to 1.0 percent salt to mixed feed or pellets. Salt blocks or spools will cause corrosion of any metal with which they are in contact, so it is not advisable to use them in all-wire hutches. In areas where the soil is deficient in certain mineral elements, use mineralized salts, as fed to other farm animals, in rabbit rations.

Water

Rabbits need ready access to fresh, pure water at all times. In summer, they require large quantities. A 10-to-12-pound doe and her 8-week old litter of seven will drink about a gallon of water in 24 hours.

Methods of feeding

Two methods of feeding are in general practice. One entails placing a measured amount of feed in feed crocks or troughs each day, and is referred to as "hand feeding." The other utilizes a hopper, or self-feeder, which holds several days' supply of feed, and is referred to as "Self-feeding" or "full-feeding," since feed is available to the rabbits at all times and they can eat at will. Crocks or troughs may be used for full-feeding, but will have to be filled more frequently than hoppers and are more susceptible to waste and contamination. The hopper feeding system saves time and labor and prevents waste and contamination if the hopper is properly constructed.

Full-feeding in crocks or troughs produces about the same results as hopper feeding, provided you feed the animals all they will consume each day without waste. If you cannot give close attention, hopper feeding will give better results.

Whether, in hand feeding, the rabbits should be fed 1, 2, or 3 times a day is largely a matter of personal preference and convenience. Regularity is more important than the number of feedings. Rabbits eat more at night than during the day, especially in warm weather.

Full feeding insures rapid growth and economical development of young to weaning. Full-fed rabbits generally require less feed than hand-fed rabbits to produce each pound of live weight because they eat frequently and slowly and chew their food thoroughly.

Occasionally a rabbit goes "off feed." When this happens, reduce the quantity of the ration. The offer of a tempting morsel of carrot, bread and milk, or fresh green feed may induce the rabbit to begin eating again.

V. HOW SHOULD I CARE FOR THE DOE AT BREEDING AND GESTATION?

The breeding schedule to follow is determined by the type of production. It is usually best not to attempt to produce more than two or three litters a year for show purposes. For meat and fur, however, work breeding animals throughout the year, if possible.

With a gestation period of 31 or 32 days and a nursing period of 8 weeks, a doe can produce four litters in a 12-month period, if no failures or "passes" occur. Does of heavy producing strains can be mated 6 weeks after kindling, and, if no failures occur, produce five litters in a year. Many commercial breeders are using breeding intervals of 21, 28 or 35 days after kindling to further increase the meat production of their herds. The general feeling is that

for most efficient production, does should be worked to the extent of their genetic reproductive capacities. Experimental evidence is lacking as to what effect these rapid breeding schedules may have on the reproductive life of the doe, fryer development, feed conversion as measured by the pounds of feed necessary to produce a pound of meat, mortality, and carcass quality.

Where extreme temperatures make it undersirable to have litters kindled during 2 or 3 months of the year, does may be rebred 42 days after kindling and still produce four litters.

If a doe is full-fed a properly balanced ration during the suckling period, she should be in condition for breeding before the litter is weaned. If, however, the doe is not in good physical condition at the scheduled breeding time, she should not be bred until she is. If the litter is lost at kindling, or the size of the litter is materially reduced for other reasons, and the doe is in good condition, she may be rebred earlier than called for by the regular schedule, but not earlier than 3 or 4 days after kindling.

Age to breed

The proper age of bucks and does for the first mating depends on breed and individual development. Smaller breeds develop more rapidly and are sexually mature at a much younger age than medium-weight or giant breeds. Does should be mated when they reach maturity; some difficulty may be experienced if mating is too long delayed. On the average, the smaller breeds may be bred when the bucks and does are 4 to 5 months old, the medium-weight breeds at 5 to 6 months, and the giant breeds at 8 to 10 months. Some individual rabbits within a breed develop more rapidly than others, and does usually mature earlier than bucks. In commercial production, it is the general practice to hold bucks a month longer than does before breeding for the first time, though there is no experimental proof that this is necessary.

Making matings

Does may give evidence of being ready for mating by restlessness, nervousness, efforts to join other rabbits in nearby hutches, and by rubbing their chin on feed mangers and water crocks. However, it is not necessary to depend on external signs to determine when a doe is to be bred. Set up a definite schedule and follow it, whether the doe shows signs of being ready for service or not.

Breed a large number of does at one time to make fryers available at a certain season for the trade, or utilize a breeding schedule to produce a constant supply. Always take the doe to the buck's hutch for service. You may have difficulty in service if you take the buck to the doe. The doe is likely to object to having another rabbit in her hutch and may savagely attack and injure the buck. Also, some bucks are slow in performing service in a strange hutch. Mating should occur almost immediately

on placing the doe in the buck's hutch. After the buck mounts and falls over on his side, the mating is accomplished. Return the doe to her own hutch.

It is difficult to get some does to accept service. Such does may be restrained for mating. To restrain the doe, use the right hand to hold the ears and a fold of the skin over the shoulders, and place the left hand under the body and between the hind legs. Place the thumb on the right side of the vulva, the index finger on the left side (you may prefer to use the index and second finger), and push the skin gently backward. This procedure throws the tail up over the back. Support the weight of the body by the left hand, and elevate the hindquarters only to the normal height for service.

Determining pregnancy

It is not accurate to determine pregnancy by "test mating" (placing the doe in the buck's hutch periodically). Some does will accept service when pregnant and others will refuse service when they are not pregnant.

You can quickly and accurately determine pregnancy by palpating, after 12 to 14 days from mating, but you must handle the doe gently. Hold the ears and a fold of skin over the shoulders in the left hand and place the other one under the shoulder between the hind legs and slightly in front of the pelvis. Then place the thumb on the right side and the fingers on the left side of the two uteri for palpating the fetuses. At 12 to 14 days following mating, the fetuses have developed into marble-shaped forms that are easy to distinguish as they slip between the thumb and fingers when the hand is gently moved forward and backward and a slight pressure is exerted. Be sure to be careful in this operation, because if too much pressure is exerted, the tissues may be bruised or torn loose from the walls of the uteri and a toxic condition or abortion result.

There is less danger of bruising the tissues or causing the fetuses to be torn loose from the walls of the uteri in palpating at 12 to 14 days than at a later period. Also, diagnosing pregnancy after the 16th day of the gestation period is more complicated because the developing fetuses are so large that they may be confused with digestive organs. The inexperienced rabbit owner should make examinations at 12 to 14 days and then as he improves his technique and attains confidence in the operation, he may be able to develop the ability for diagnosing pregnancy accurately as early as the 7th or 8th day.

VI. CARING FOR THE DOE AND LITTER DURING KINDLING AND LACTATION

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Kindling

Place a nest box in the hutch about 27 days after the doe is mated. This allows the doe to prepare a nest in ad-

may be frightened and kindle prematurely. If she is disturbed after the litter is born and jumps into the nest box, she may stamp with her back feet and injure or kill the newborn rabbits.

Occasionally a doe fails to produce milk. Then, the young will starve within 2 or 3 days unless the condition is noted and the young transferred to foster mothers. Keep a close check on newborn litters for several days after birth to make sure they are being fed and cared for properly.

Does sometimes eat their young. This may result from a ration inadequate in either quantity or quality, or from the nervousness of a doe disturbed after kindling. It is also possible that the doe is of a strain that exhibits poor maternal instincts. Does usually do not kill and eat healthy young, but limit their cannibalism to young born dead, or those that are injured and have died. Proper feeding and handling during pregnancy will do more than anything else to prevent this tendency. Give another chance to a valuable doe that destroys her first litter. If she continues the practice, dispose of her.

Lactation

During the last week of pregnancy, the mammary glands develop rapidly. Though milk may be produced before kindling, and actually leak from the glands of high-producing does, the actual letdown and production is usually delayed until kindling, and is initiated under hormonal and nervous stimuli induced by the action of suckling. Maximum milk production is usually reached by the third week, after which production gradually declines. The duration of lactation varies depending upon diet, number of suckling young, and the length of time the young are left with the doe. Ordinarily, milk production is negligible after the sixth or seventh week, though in well-nourished, high-producing does with a litter of eight or nine, milk production may last for 8 weeks or longer. Milk has been observed in the stomachs of young weaned from the doe at 8 weeks of age, and milk can be expressed from the glands for several days thereafter.

The amount of milk produced depends upon several factors, such as breed, strain, diet, and genetic constitution. Various studies of milk production in the rabbit indicate that during the height of lactation, a 10-pound doe produces approximately 140 grams (5 ounces) of milk per day.

Contrary to popular belief, the doe does not nurse her young throughout the 24-hour period. For the very young in the nest box, nursing is usually performed during the night or early morning. It may consist of a single feeding of only a few minutes. After the young leave the nest box and are consuming solid food they will try to nurse several times during the day. However, the doe will usually push them aside and restrict their nursing to the night time. Students of animal behavior attribute the nursing habits of the doe to the fact that rabbits in their natural habitat

are extensively preyed upon and rather helpless to defend their young. Therefore, it is advantageous for the doe to stay away from the young as much as possible.

Weaning

Under most management programs, the young are weaned at 8 weeks of age. At that age young meat rabbits should average 4 pounds in weight and be ready for market. Some commercial producers leave the young with the doe for 9 or 10 weeks to get a 4½-5½-pound fryer. Small litters (fewer than five young) can be weaned at an earlier age and the doe rebred. Also, under accelerated breeding programs where does are bred less than 35 days following kindling, it is advisable to wean the young at 5, 6, or 7 weeks of age to allow the doe to prepare for her next litter. It is best to allow a few days between removal of one litter and birth of the next. For example: if a doe is bred 28 days after kindling, it is possible to leave the litter with her until they are 56 days of age, allowing for kindling about 3 days later. It depends upon the condition of the doe and her ability to stand up under this type of program. You may wish to remove the young at 7 weeks of age and give the doe 7 to 10 days to prepare for the next kindling.

III. PREVENTING INJURIES AND DISEASES

Success in raising rabbits depends on efficient management. Become thoroughly acquainted with your animals--their characteristics and behavior, their likes and dislikes. Consideration for the welfare of animals is always necessary for success in raising them. Proper arrangement of equipment, hutches, and buildings is also essential to efficient management. When you enter the rabbitry, make your presence known. Otherwise, the rabbits may become frightened, race around in the hutch and injure themselves, or jump into the next boxes and injure the litters.

Methods of handling rabbits

Never lift rabbits by the ears or legs. Handling in this manner may injure them.

You can lift and comfortably carry small rabbits by grasping the loin region gently and firmly. Put the heel of the hand toward the tail of the animal. This method prevents bruising the carcass or damaging the pelt.

To lift and carry a medium-weight rabbit, let the right hand grasp the fold of skin over the rabbit's shoulder. Support the rabbit by placing the left hand under its rump.

Preventing injuries

Paralyzed hindquarters in rabbits usually result from improper handling or from injuries caused by slipping in the

hutch while exercising or attempting to escape predators, especially around kindling time. Such slipping usually occurs at night. Common injuries are dislocated vertebrae, damaged nerve tissue, or strained muscles or tendons. If the injury is mild, the animal may recover in a few days. Make the injured animal comfortable and feed it a balanced diet. If it does not improve within a week, destroy it to prevent unnecessary suffering. It is important, therefore, that your rabbits be provided with quiet, comfortable surroundings and be protected from predators and unnecessary disturbances.

The toenails of rabbits confined in hutches do not wear normally. They may even become long enough to cause foot deformity. The nails may also catch in the wire mesh floor and cause injury and suffering. Periodically cut the nails with side cutting pliers. Cut below the tip of the cone in the toenail. The cone can be observed by holding the foot up to daylight. This will not cause hemorrhaging or injury to the sensitive portion.

Preventing sore dewlaps

During warm weather the dewlap, or fold of skin under the rabbit's chin, may become sore. This is caused by drinking frequently from crocks and keeping the fur on the dewlap wet so long that it becomes foul and turns green. The skin on the dewlap and on the inside of the front legs becomes rough and the fur may be shed. The animal scratches the irritated area, causing abrasions and infection.

Sanitation and disease control

To protect the herd's health, keep the equipment sanitary. Remove manure and soiled bedding at frequent intervals and contaminated feed daily. Inspect water crocks and feed troughs daily and wash them frequently in hot, soapy water. Rinse them in clear water; allow them to drain well, and place them in the direct rays of the sun to dry. If it is impractical to sun the equipment properly, rinse it first in water to which a disinfectant has been added and then in clear water.

To prevent or control a disease or parasitic infection, thoroughly disinfect hutches and equipment which have been occupied, or used, by sick animals, or where excessive mortality has occurred. One of the coal tar derivatives or household disinfectants may be used. Allow hutches and equipment to dry before returning rabbits to them. A large blowtorch or weedburner may be used periodically to remove hair and cobwebs and to disinfect nest boxes before using them a second time.

Maintaining sanitary conditions in the rabbitry is a preventive measure for controlling disease in the herd. Be constantly on the alert for the appearance of any sign that might indicate disease at least 2 weeks to determine definitely

whether they are dangerous to the health of the herd. Place newly acquired rabbits and those returned from shows in quarantine at least 2 weeks for the same reason. Burn or bury dead animals.

VIII. HOW SHOULD I DRESS THE FRYER RABBIT?

Suspend the carcass on a hook inserted between the tendon and the bone of the right hind leg just above the hock. Remove the head immediately to permit thorough bleeding so the meat will have a good color. Remove the tail and the free rear leg at the hock joint, and cut off the front feet. Then, cut the skin just below the hock of the suspended right leg and open it on the inside of the leg to the root of the tail, continuing the incision to the hock of the left leg. If you are saving the pelt, carefully separate the edges of the skin from the carcass, taking special pains to leave all fat on the carcass as the skin is pulled down over the animal. This makes a more attractive meat product, facilitates drying the skin, and prevents "fat burns" on the pelt in drying.

After skinning the carcass, make a slit along the median line of the belly and remove the entrails and gall bladder. Leave the liver and kidneys in place. Remove the right hind foot by severing at the hock. Take particular care not to get hairs on the carcass; they are difficult to remove, detract from the appearance, and are unsanitary. Rinsing the carcass in cold water facilitates removal of hair and blood and also cleans the carcass. Brush the rabbit's neck thoroughly in water to remove any blood. Do not leave the carcass in water more than 30 minutes; prolonged soaking causes it to absorb water, and water in the meat is adulteration. Chill the carcass in a refrigerated cooler to 36 to 40° F.

This subject-matter unit was taken primarily from U.S. Department of Agriculture Handbook No. 309, entitled "Commercial Rabbit Raising."

Local Adaptation --- Animal Science

HORSE BREEDS

Instructor's Guide

1. This is an animal science local adaptation unit. Teach this unit if horse production is of economic importance to the region your vocational agriculture program serves.
2. Have students write to the breed associations to gather information.
3. Have students report their findings.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds of horses and for horse selection.
6. Use slide sets of breeds to identify breed traits.
7. Order student reference materials from
 Vocational Instruction Services
 Texas A & M University
 College Station, Texas 77843
8. VEP has an excellent slide/tape instructional package available on horse production. Address below:

Vocational Education Productions
 Calif. Poly. State University
 San Luis Obispo, CA 93407

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed association.
3. Compare the advantages and disadvantage of the breeds.
4. Select the breeds most suited to their location and personal desires, and select animals based on conformation.
5. Understand and be able to use terms common to the horse industry.
6. Identify major breeds of horses.
7. List the physical traits of major breeds of horses.
8. Understand basic management concepts for horse production.

References

1. VEP instructional package
2. Texas A & M student materials on Horse Production
3. OSU 4-H Club Extension materials
4. Gillespie, James R., Modern Livestock and Poultry Production, 1981, Delmar
5. Ensminger, M.E., The Stockman's Handbook, 1978, Interstate

Teaching Aids

1. Overhead projector with transparencies.
2. Pictures of breeds of horses.
3. Breed Association publications.
4. Slides of horse breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of horses.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Name _____

AGI-XIII-3

Glossary of Terms

- Thoroughbred - a term used synonymous to purebred, but is incorrect; applies to a breed of horses.
- Foal - young animal of the equine species under 12 months of age.
- Gelding - male horse which has been castrated.
- Stallion - male horse of breeding age.
- Equine - horse species.
- "V" muscle - the muscles of the chest of a horse which give the appearance of an inverted "V".
- Broodmare - a female horse used for breeding purposes.
- Draft animal - animal used for work stock and in some countries is still used for plowing and pulling heavy loads.
- Early speed - ability of a horse to obtain his maximum speed in one or two strides.
- Fertility - capable of breeding or reproducing.
- Flat boned -reference made to the cannon bone region of a horse's leg, which is constituted by the bone, ligaments, and tendons.
- Gaited - definite rhythmic movement of a horse such as trot, canter, pace, etc; certain breeds are selected and bred on the basis of their ability to perform the various gaits.
- Gather - horseman's term for collection in an animal.
- Gelding -a castrated male horse.
- Hand - the height of a horse; the measurement is taken from the top of the withers to the ground; a hand is four inches.
- Splayed - a common fault found in horses which means that the front hooves are turned out and the heels turned in.
- Splints - abnormal bony growth found on the canon bone of some horses.
- Stock horse type - horses of the Quarter, Paint and Appaloosa breeds, mainly Thoroughbred and Arabian; bred for early speed, agility, disposition and intelligence.
- Tobiano - basically, a white horse in which large, smooth and solid blocks of color originate on the back and rump and extend down. The fact is usually marked the same color as in other color patterns found in horses.
- Tracks - a term used to describe the leg movements of a horse while he is walking.

Breeds of Horses

*Terms: All terms underlined are in the "Glossary of Terms."

1. History of the Horse

The evolution of the horse to its present day type has been established through studies made of fossil remains. The earliest form which was found to have existed on the North American continent was a very small four-toed, even-toothed animal about twelve inches high. These small horses grazed the swamp lands and ranged very short distances. As the oceans receded and the land changed, these horses developed into taller, longer legged individuals because it became necessary for them to range farther distances from sources of water. In the process, the middle toe grew longer and formed the hoof, and the other toes disappeared into rudimentary toes which are today the splint bones visible under the skin. The teeth became longer for grazing prairie grasses, and the longer legs and hooves provided the speed which was necessary for protection and for grazing great distances.

About 5,000 years ago the horse became extinct on the North American Continent. The disappearance was so complete and so sudden that many scientists believe it was caused by some contagious disease or fatal parasite. Others believe it was a combination of climatic changes, competition, and/or failure to adapt.

The horse was re-established about 500 years ago in North America by the Spanish conquistadores. In the early evolutionary period some of the horses migrated to Asia and Africa where the wild herds, from which our present horses evolved, became established.

There are three species of the horse family:

- (1) Horse
- (2) Ass or donkey
- (3) Zebra, an undomesticated species

The Prazewalsky's horse found in Mongolia is the only living species of the original wild horse today. The ass and zebra are both still found in the wild state.

The horse was the last animal to be domesticated. Humans have had a tremendous influence on the horse's development since its domestication. The many uses of the horse by people has brought about the great variety of types which are prevalent today.

The selective mating of large, heavily muscled horses to produce work animals; the development of refined, longer legged horses for speed; and the development of various gaits for ease in riding or pulling have all been influence of humans in the development of the present-day horse.

The horse's role in the development of America should not be under estimated. The horse pulled the wagons west, it provided transportation, it was irreplaceable in the handling of livestock, it carried the mail, and it built the railroads. Generally, racing and rodeos furnished the principal pleasure for people in the early communities. Although today the use of the horse as a source of power has declined because of mechanization, it is still used in many areas. In the western states, the rancher has not found a replacement for the cow horse; in some logging areas and in some small farming areas, draft horses and mules, which are hybrids of horses and asses, are still used.

The horse has never been more popular nor existed in greater numbers in the United States than it does today. Racing is a very popular spectator sport, and horse shows and rodeos continue to reach a new peak in the number of participants and spectators each year. The major income in many states derives from the selling and racing of horses. The value and breeding fees of outstanding horses of various breeds have never been higher.

The development of associations and registries of the various breeds, and their organized activities have influence the horse's popularity tremendously. Each breed has been developed for a particular purpose. Through selective breeding programs, management, and training, each breed has continued to improve.

II. Growth and Decline of the U.S. Horse Industry

Prior to 1900, the automobile and tractor were relatively unknown on the American scene. Horses and mules supplied practically all of the farm power and were widely used for transportation. The horse population in the United States increased up to 1915, at which time a record number of 21,431,000 head was recorded. On January 1, 1968, the horse population in the United States had declined to 6,625,000. Since 1968, the horse population in the United States has risen slowly each year.

III. Types and Classes of Horses

Many diverse and distinct types are recognized within the horse breed. Generally, horses may be classified as light horses, ponies, or draft horses, depending on size, build, and use.

Light horses stand 14-2 to 17 hands high, weight 900 to 1,400 pounds, and are used primarily for riding, driving, or racing. Light horses generally are more rangy and are capable of more action and greater speed than draft horses.

Ponies stand under 14-2 hands high and weight 500 to 900 pounds.

Draft horses stand 14-2 to 17-2 hands high, weigh 1,400 pounds or more, and are used primarily for drawing loads and for heavy work.

Transparency No. 1

Horses may be further classified according to specific type and use.

IV. Breeds of Horses

A breed of horses may be defined as a group of horses having a common origin and possessing certain well-fixed, distinctive, uniformly transmitted characteristics that are not common to other horses. An important factor to consider when attempting to choose a particular breed is that certain breeds are better adapted for specific purposes. In this study, an attempt will be made to identify the distinctive characteristics of the breeds of horses.

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
American Albino	A. United States; Naper, Nebraska	(1) Color...White hair; pink skin; and light dark blue, brown, or hazel eyes (2) Height...14 to 15-2 hands (3) Weight...1,000-1,300 lbs.	(a) Riding and exhibition purposes (b) Parade and flag bearer horses
American Paint Horse	A. United States	(1) Color...White, with any other color; must be a recognizable paint. The two distinct patterns are: <u>Overo</u> and <u>Tobiano</u> (2) Height...14-1 to 16-2 hands (3) Weight...750 to 1,300 lbs	(a) Stock horses (b) Pleasure horses (c) Show purposes (d) Racing
American Saddle Horse	A. United States: Fayette County, Kentucky	(1) Color...Bay, brown, chestnut, gray, black or golden (2) Height...15-16 hands (3) Weight...1,000-1,200 lbs.	(a) Three and five-gaited horses (saddle) (b) Pleasure horses (c) Stock horses (d) Fine harness horses
Appaloosa	A. United States in Idaho, Oregon, and Washington B. From animals originating in Central Asia	(1) Color...Variations and combinations of colors and spots, eye encircled by white, mottled skin, hooves black and white spotted. Usually white over loin and hips, with spots intermingled. (2) Height...14 to 15 $\frac{1}{2}$ hands (3) Weight...900 - 1,200 lbs.	(a) Stock horses (b) Pleasure horses (c) Race horses (d) Parade horses

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Arabian	A. Arabia	(1) Color...Bay, gray and chestnut are predominant; white marks on the head and legs are common (2) Height...14 to 15-1 hands (3) Weight...850-1,100 lbs. (4) The beautiful head and neck of the Arabian is one of its most distinguishing characteristics.	(a) Saddle horses (b) Show horses (c) Stock horses (d) Pleasure horses (e) Racing
Cleveland Bay	A. In the Cleveland District of Yorkshire, England	(1) Color...Bay with black legs. (2) Height...15-3 to 16 hands (3) Weight...1,250-1,450 lbs.	(a) Stock horses (b) Parade horses (c) Pleasure purposes (d) Used in cross-breeding to produce heavy-weight hunters
Morgan	A. United States in the state of Vermont B. As a general-purpose horse	(1) Color...Bay, brown, black and chestnut are preferred colors; white markings are less common than in other breeds (2) Height...14-2 to 15-2 hands (3) Weight...1,000-1,200 lbs (4) Noted for pleasing temperament and easy manageability (5) Remarkable endurance	(a) Saddle horses (b) Stock horses

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Palomino	A. United States	(1) Color...Golden and white, silver or ivory mane and tail; coat color is its greatest asset	(a) Parade horses (b) Pleasure horses (c) Stock horses (d) Saddle horses
		(2) Height..14-2 to 16 hands	
		(3) Weight..900-1,300 lbs.	
		(4) The type desired in the Palomino will depend entirely on the use for which the horse is intended.	
Pinto	A. United States	(1) Color...Half color or colors (bay, brown, black) and half white spots ranging from two to twelve inches across	(a) Hunters (b) Polo mounts (c) Racing (d) Saddle horses (e) Stock horses
	B. From horses brought in by Spanish conquistadores	(2) Height..14-1 to 16-2 hands	
		(3) Weight..750 - 1,300 lbs.	
		(4) Type not color determines whether a horse is properly identified as a Pinto or Paint or both. The Pinto Registry accepts several breed types while the Paint Horse Association accepts only Quarter or Thoroughbred conformation	

BREED.	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Quarter Horse	A. United States; primarily in the southwestern states of Texas, Oklahoma, New Mexico, Colorado, and Kansas	(1) Color...Chestnut, sorrel, bay, dun, palomino, black, brown and roan (2) Height..14 to 16 hands (3) Weight..1,050-1,300 lbs. (4) Well-muscled and powerfully built; considered the most versatile of all	(a) Stock horses (b) Racing (c) Pleasure horses
Standard Bred	A. United States	(1) Color...Bay, brown, chestnut, black, gray, roan and dun (2) Height..15 to 16 hands (3) Weight..900-1,300 lbs. (4) The breed was developed primarily for harness racing; a pleasing conformation and an abundance of style and quality are important requirements	(a) Harness racing (b) Trotting or pacing (c) Show horses
Tennessee Walking Horse	A. Tennessee, United States	(1) Color...Sorrel, chestnut, black, roan, white, bay, brown, gray, golden (2) Height..14 to 15 hands (3) Weight..1,000-1,200 lbs (4) The running walk is distinctive to the breed	(a) Plantation walking horses (b) Pleasure horse (c) Show horse

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Thoroughbred	A. England B. Developed as a running horse	(1) Color... Bay, brown, chestnut, sorrel, black and gray; white markings on the face and legs are common (2) Height... 15 to 17 hands (3) Weight... 900-1,400 lbs. (4) Conformation emphasizes factors contributing to racing and sports	(a) Race horses (b) Saddle horses (c) Stock horses (d) Hunters and jumpers (e) Polo mounts
<u>Ponies</u>			
Hackney	A. England	(1) Color... Chestnut, bay and brown are most common; white markings are desirable (2) Height... 12 to 16 hands (i) Hackneys under 14-2 are referred to as ponies (ii) Those over 14-2 are referred to as horses (3) Weight... 800-1,200 lbs. (4) A heavy horse for its size with considerable width through the chest	(a) Heavy harness or carriage horse (b) Valued chiefly for show purposes (c) Also for cross-breeding to produce hunters and jumpers

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Pony of the Americas	A. United States: Mason City, Iowa	(1) Color...Very similar to the Appaloosa; several color patterns are acceptable (2) Height...At maturity the POA must have a minimum height of 46"and a maximum height of 54" at the withers. (3) Weight...400-800 lbs. (4) The breed standard calls for a conformation between that of the Quarterhorse and the Arabian.	(a) Western type using pony for youth
Shetland Pony	A. Shetland Isles	(1) Color...Black, dark brown, bay, chestnut, mouse, and spotted are most common (2) Height...Two class sizes are recognized by breed registry: (i) 43" and under (ii) 43" to 46" (3) Weight...300-500 lbs. (4) Develops long shaggy outer coat during winter months and has a full mane and tail (5) Smaller size of show ring type is more desirable	(a) Child's mount (b) Harness (c) Racing (d) Roadster

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Welsh Pony	A. Wales	(1) Color...Black, gray bay, roan, cream or chestnut	(a) Child's mount (b) Harness racing (c) Pleasure riding (d) Parade (e) Hunting
		(2) Height...Two divisions are acceptable in the American Welsh Study Book: "A" Division: Cannot exceed 12-2 hands. "B" Division: Over 12-2 and not more than 14 hands	
		(3) Weight...Usually less than 500 lbs. on "A" type. On "B" type, 500-900 lbs.	
<u>Draft Horses</u>			
American Cream Horse	A. United States	(1) Color...Cream, with white mane and tail	(a) Exhibition purposes (b) Farm work
	B. Only draft horse breed to originate in the U.S.	(2) Size...Medium draft breed Average mature weight Male: 1,700-1,900 lbs. Female: 1,500-1,700 lbs.	
		(3) Docile	
Belgian	A. Belgium	(1) Color...Bay, chestnut, and roan are most common, but browns grays and blacks are occasionally seen	(a) Exhibition purposes (b) Special attractions (c) Farm work
		(2) Size...Known for its draftiness, wide deep, compact, low set Average Mature weight Male: 1,900-2,200 lbs. Female: 1,850-2,100 lbs.	
		(3) Very docile and quiet	

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Clydesdale	A. Scotland	(1) Color... Bay, brown	(a) Exhibition purposes
	B. First imported to Canada in the 1870's	with white	(b) Special attraction
		markings are most common, but blacks, grays, chest-nuts, roans are occasionally seen	(c) Farm work
		(2) Size.... Medium draft breed Average mature weight Male: 1,700 - 1,900 lbs. Female: 1,500 - 1,700 lbs. Height: 16 - 17 hands	
Percheron	A. France	(3) Superior style and action	
		(4) Heavy <u>feathering</u> of feet	
		(1) Color... Black or gray,	(a) Exhibition purposes
	B. First imported in the 1840's	occasionally bays, browns, chestnuts, and roans are seen	(b) Special Attractions (c) Farm work
		(2) Size.... Between the Clydesdale and Belgian Average mature weight Male: 1,800 - 2,000 lbs. Female: 1,700-1,850 lbs Height: 16-1 to 16-3 hands	
		(3) Extremely docile	
		(4) Noted for its clean-cut head	
	A. England	(1) Color... Bay, brown	(a) Exhibition purposes
Shire	B. First imported in 1936 to Canada	black with white	(b) Special attractions
		markings, occasionally grays, chest-nuts and roans are seen	(c) Farm work
		(2) Size.... The tallest draft breed.	

BREED	ORIGIN	DISTINGUISHING CHARACTERISTICS	USES
Suffolk	A. England B. First imported in the 1880's	(2. Size, Cont'd) Average Mature weight Male: 1,600 to 1,800 lbs. Female: 1,450-1,600 lbs. Height: 16 to 17 hands	
		(3) Docile	
		(4) Feathers or hair on the legs	
		(1) Color...Chestnut varying from light to dark; no white	(a) Exhibition purposes (b) Special attractions (c) Farm work
		(2) Size....Smallest draft breed Average mature weight Male: 1,600 to 1,800 lbs Female: 1,450 to 1,600 lbs. Height: 15-2 to 16-2 hands	
		(3) Excellent disposition	
		(4) Conformation is of the chunky type	

Horse Breed Registry Addresses

1. American Albino Association, Inc.
Box 79
Crabtree, Oregon 97335
2. American Paint Horse Association
P.O. Box 18519
Fort Worth, Texas 76118
3. American Saddle Horse Breeders Assoc.
929 South Fourth Street
Louisville, Kentucky 40203
4. Appaloosa Horse Club, Inc.
P.O. Box 403
Moscow, Id. 83843
5. Arabian Horse Registry of America, Inc.
c/o Ralph Clark
3435 So. Yosemite Street
Denver, Co. 80231
6. Cleveland Bay Society of America
White Post, Va. 22663
7. The Morgan Horse Club, Inc.
P.O. Box 2157
West Hartford, Ct. 06117
8. The Palomino Horse Association, Inc.
Box 249
Mineral Wells, Texas 76067
9. Pinto Horse Association of America, Inc.
7525 Mission Gorge Rd.
San Diego, CA 92120
10. American Quarter Horse Association
2736 W. 10th Street
Amarillo, Texas 79168
11. Standardbred - United States Trotting
Association
750 Michigan Avenue
Columbus, OH 43215
12. Tennessee Walking Horse Breeders
Association of America
P.O. Box 286
Lewisburg, TN 37091
13. Thoroughbred - The Jockey Club
300 Park Avenue
New York, NY 10022

Breeds of Ponies

1. American Hackney Horse Society
527 Madison Avenue
Room 725
New York, NY 10022
2. Pony of the Americas Club, Inc.
P.O. Box 1447, 1452 N. Federal
Mason City, IA 50401
3. American Shetland Pony Club
P.O. Box 435
Fowler, IN 47944
4. Welsh Pony Society of America
c/o Gail Hamilton
P.O. Drawer A
White Post, VA 22663

Breeds of Draft Horses

1. American Cream Horse Association
Hubbard, IA 50122
2. Belgian Draft Horse Corporation of America
c/o Blanche Schmalzried
Wabash, IN 46922
3. Clydesdale Breeders' Association of America
c/o Betty Groves
RR 1, Box 131
Pecatonica, IL 61063
4. Percheron Horse Association of America
Rural Route 1
Belmont, Ohio 43718
5. American Shire Horse Association
c/o Heather Erskine
14410 High Bridge Road
Monroe, WA 98272
6. American Suffolk Horse Association, Inc.
c/o J.R. Coughlon
672 Polk Blvd.
Des Moines, IA 50312

CLASSIFICATION OF HORSES ACCORDING TO TYPE AND USE

A. Riding Horses:

1. SADDLE (THREE GAITED, FIVE GAITED)
2. WALKING
3. STOCK
4. POLO
5. HUNTERS AND JUMPERS
6. PONIES

B. Race Horses:

1. RUNNING (THOROUGHBRED, QUARTER ETC.)
2. HARNESS (TROTTERS AND PACERS)

C. Driving horses:

1. HEAVY HARNESS
2. FINE HARNESS
3. ROADSTERS
4. PONIES (HEAVY AND LIGHT HARNESS)

D. Work horses:

1. DRAFT
2. WAGON
3. EXHIBITION



SELECTED STUDENT ACTIVITIES

1. Write the name of the horse breed in the space that is provided for each description that follows:

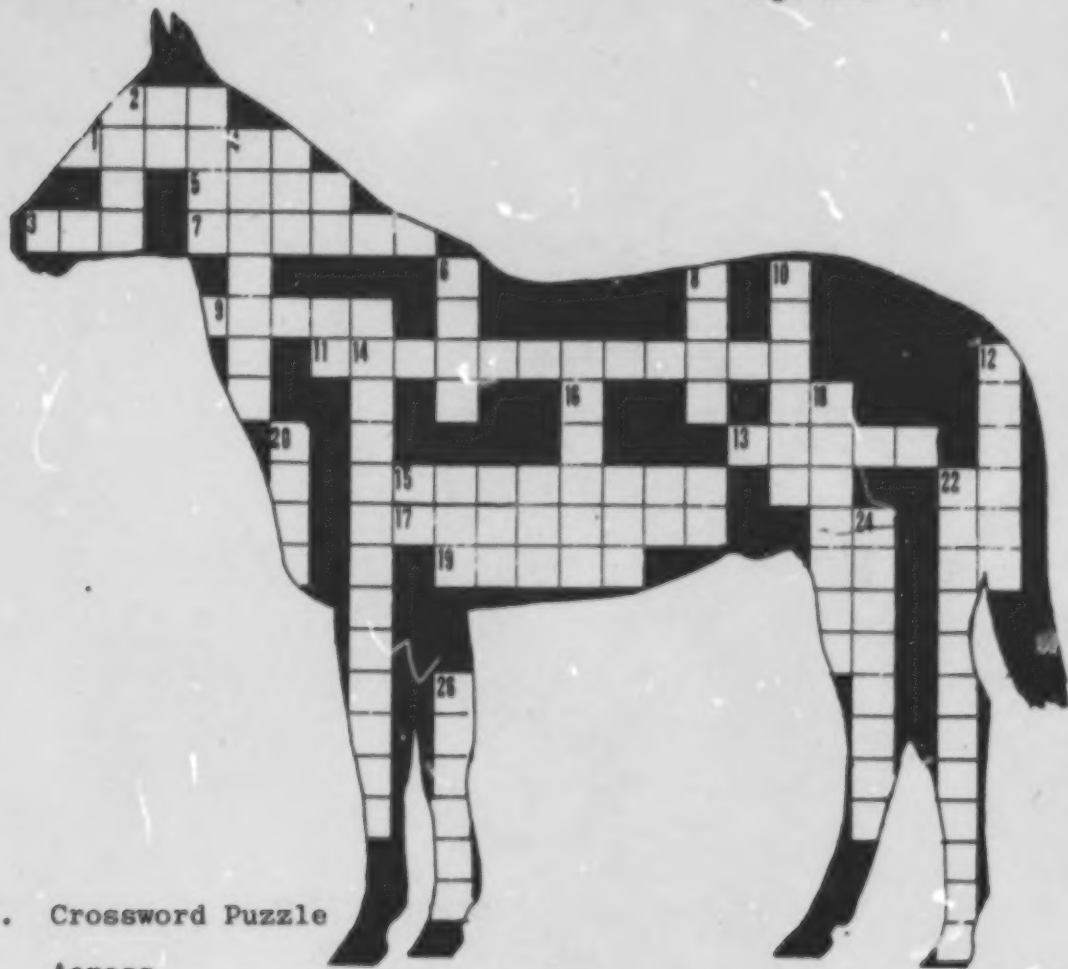
- _____ Golden and white body color with ivory mane and tail
- _____ Usually white over loin and hips with spots
- _____ White body with pink skin
- _____ Pony with conformation between that of a Quarterhorse and an Arabian
- _____ Pony breed which sometimes develops a long shaggy outer hair coat during winter months
- _____ Draft breed imported from France which is noted for its docility
- _____ Overo and Tobiano are two of its distinct color patterns
- _____ A heavy harness pony noted for its width through the chest
- _____ Its conformation emphasizes factors contributing to racing and sports
- _____ Draft breed originating in Belgium
- _____ Considered the most versatile of the light horse breeds
- _____ Only draft horse breed to originate in the United States
- _____ The running walk is distinguishing characteristics
- _____ A beautiful head and neck is one of its most distinguishing characteristics
- _____ A general purpose light horse breed that is noted for its pleasing temperament and easy manageability
- _____ Type not color determine whether a horse is properly identified as this light breed
- _____ Light horse breed often used in crossbreeding to produce heavy-weight hunters

_____ A light breed developed primarily for harness racing

_____ A draft breed originating in Scotland which is characterized by heavy feathering of the feet

_____ Three-and five-gaited horse which originated in Kentucky

2. List the names of the breeds of horses which are found in your county or locality.
3. Select the horse breeds of your choice and write to the breed associations for additional information and pictures.
4. List the major uses made of horses in your county or locality.
5. In your opinion, are horses contributing to the agricultural economy in your locality? Explain why or why not.



6. Crossword Puzzle

Across

1. A general purpose, light breed horse, originating in the U.S. in the state of Vermont.
2. A miniature Appaloosa colored pony breed (abbr.)
3. Red body color with black legs, mane, and tail.
5. One of the preferred colors of the Arabian breed.
7. Popular sport in which light horse breeds such as the Thoroughbred and Quarterhorse are popular.
9. Characterized by color pattern of bay, brown, or black, and white spots.
11. A light horse breed developed in the U.S. primarily for harness racing.
13. One of the popular colors of the Quarterhorse breed.
15. A pony breed which is popular as a child's mount.
17. One of the primary uses of the American Saddle Horse.
19. Horse breed type classification in which the Quarterhorse fits.

Down

2. Horse breed type classification in which the Hackney fits.
4. A beautiful head and neck is one of its most distinguishing characteristics.
6. Measure of the height of a horse.
8. One of the primary uses of the draft breeds.
10. One of the uses of the Arabian breed is as a _____ horse.
12. Body color usually appearing with a flaxen mane and tail.

14. A light horse breed developed primarily for harness racing.
16. A child's pony originating in Wales.
18. One of the race horse types including trotters and pacers.
20. A horse color consisting of a combination or mixture of colors.
22. Popular light horse breed developed primarily in the Southwestern states.
24. A light horse breed of Spanish descent used quite often for parade purposes.
26. The Tennessee Walking Horse is recognized as a three- or five-_____ horse for one of its specific uses.

SELECTION OF HORSES

OBJECTIVES

Upon completion of this unit the students will be able to:

1. Determine and describe traits to use in selection of horses.
2. Explain why conformation is the basis for selection.
3. List the ultimate objective in producing horses.
4. List and describe 5 factors to consider when selecting a breed of horse.
5. Identify the parts of the major classes of horses.
6. List the factors to consider in horse selection.
7. Use selection tools, such as pedigree and production records, in the selection of horses.

Teaching Aids

1. Pedigree record of horses.
2. Charts of classes and breeds of horses.
3. Slides, filmstrips, movies, etc.
4. Breed association publications.

Student Activities

1. Take a field trip to judge and select horses.
2. See student materials, "Selecting Horses."

Glossary of Terms

- Broodmare - a female horse used for breeding purposes.
- Draft animal - animal used for work stock and, in some countries, is still used for plowing and pulling heavy loads.
- Equine - the horse family.
- Early speed - ability of a horse to obtain his maximum speed in one or two strides.
- Gaited - definite rhythmic movement of a horse such as trot, canter, pace, etc.; certain breeds are selected and bred on the basis of their ability to perform the various gaits.
- Gather - horseman's term for collection in an animal.
- Gelding - a castrated male horse.
- Hand - the height of a horse. The measurement is taken from the top of the withers to the ground; a hand is four inches.
- Mare - a female horse.
- Overo - basically white in color and the spotting is usually roan and extends upwards from the belly. The darker areas are usually small or rather ragged patches; the mane and tail are usually a mixture of color giving a roan effect. Overo horses usually have bald faces, and glass eyes are not uncommon.
- Splayed - a common fault found in horses which means that the front hooves are turned out and the heels turned in.
- Splints - abnormal bony growth found on the cannon bone of some horses.
- Stag - a male animal that was castrated after it reached sexual maturity (horses excluded)
- Stallion - a male horse.
- Stock horse type - horses of the Quarter, Paint and Appaloosa breeds, mainly Thoroughbred and Arabian; bred for early speed, agility, disposition and intelligence.
- Tobiano - basically, a white horse in which large, smooth and solid blocks of color originate on the back and rump and extend down. The fact is usually marked the same as in other color patterns found in horses.
- "V" muscle - the muscles of the chest of a horse which give the appearance of an inverted "V".

SELECTING HORSES

- * Terms: All terms underlined are included in the "Glossary of Terms."

I. Use as a Basis for Selection

The purpose for which a horse will be used is one of the first criteria to be considered in the selection of horses. From the standpoint of use, all equine can be separated into two major categories, (a) work horses or draft horses, and mules, and (b) light horses and ponies.

Draft horses and mules were bred and developed for their strength and are used for logging, plowing and other work for which power and strength are necessary.

The light horse breeds include all breeds other than the draft breeds. In Oregon, purposes for which light horses are used include: ranch work, racing; rodeo uses such as roping, barrel racing, dogging, grand entries; horse show events such as alter, reining, various pleasure classes, roping, barrel racing, cutting; working cow horse events; pole bending, trail classes; jumping; gaited classes; and costume classes; trail riding; parades; personal pleasure; breeding, and others.

When selecting a horse, it is important to first determine the purpose for which it will be used. After the purpose or purposes have been determined, then the breed or breeds which have been developed to perform these purposes should be considered.

Unlike all other classes of livestock, horses are produced primarily for purposes other than a source for human food. Since the value of a horse is based on live performance, carcass data cannot be related to live conformation in order to determine the ideal. However, other criteria have been established by equine breeders, anatomists, trainers, veterinarians, and other horse specialists which provide sound basis for selection.

II. Breed as a Basis for Selection

In selecting a breed, an individual should consider several factors.

- A. First, he/she must determine what breed or breeds are capable of best performing the purpose or purposes for which the horse is to be used. For example; in selecting a breed for the purpose of roping, it is necessary that the animal be capable of a fast break, early top speed, capable of a sudden stop, calm in disposition, strong but agile,

and cow sense. The Quarter Horse, Paint and Appaloosa breeds have been bred and developed to possess these characteristics. Therefore, for the purpose of roping, these three breeds would be considered.

- B. Secondly, the access to shows or contests where the horse will be used or exhibited will help one to decide upon the breed to be selected. Each breed association provides for horse shows and contests for horses registered in its contests or shows, it would be necessary to select a breed for which shows and contests are provided in the particular locality.
- C. A third consideration in selecting on the basis of breed is the diversity of the breed or its ability to perform in several capacities. For example; the Quarter Horse breed is known for its great ability to adapt to all phases of ranch work and also to perform several show and rodeo events. Quarter Horses are also superior to other breeds in short distance races. Therefore, if a horse of the Quarter Horse breed were selected to make a roping horse, it would also have value for other purposes.
- D. A fourth consideration in selecting on the basis of breed is cost. Certain breeds of horses demand larger prices than others. However, in considering cost, an individual must keep in mind the purpose for which the animal is being selected. The cost of one breed may be more than the cost of another; however, based on performance, the more expensive breed may be cheaper in the long run. For example; again using roping as the purpose for which a horse is to be selected, a Paint horse may be more expensive than a Morgan, but the Paint horse possesses those characteristics necessary for roping and would be the best selection for this purpose.
- E. Individual preference is very important and the fifth factor in the selection of a breed. If two or more breeds possess the necessary qualifications to perform a specific function, the individual should select the breed which he likes best, for maximum satisfaction and performance. For example; individuals of the Appaloosa, Paint and Quarter Horse breeds all possess characteristics necessary in making a good rope horse; however, if the individual selecting the breed likes the Appaloosa better than the Paint or Quarter Horse, he will be better satisfied with an animal of this breed.

- F. In considering breed selection, a person who is not fully acquainted with the various breeds, their characteristics, association's rules and regulations, the registries, etc., should write the associations for available information, read the various breed publications, and talk to competent breeders and trainers.

The light horse class includes types ranging from gaited breeds to race breeds. Ideal conformation and purposes are so different, each type should be discussed separately. The objective of this discussion will be to establish a basis for selecting the stock horse type and will include those breeds which are bred for those purposes.

III. Selection based on Individuality

There are many factors to be considered in the selection of the individual animal. After the purpose for which the horse is to be used and the breed of horse have been determined, the next step is the selection of the individual animal. Individuality is of major importance in selection as there may be a greater difference between individuals of the same breed than between individuals of two different breeds.

The stock horse (Quarter, Paint and Appaloosa breeds and some crosses with other breeds, mostly thoroughbred and Arabian) is considered the most versatile of horses. They have been selected and bred on the basis of their athletic abilities, early speed, and disposition, making them best adapted to all aspects of ranch work, arena performance (other than gaited classes) and short distance racing. Thus, the selection of the individual stock horse type is based on several factors; conformation, disposition, intelligence, bloodline, sex, age, performance, and soundness.

A. Selection on the Basis of Conformation

The ideal in conformation varies somewhat among the various breeds of light horses. However, certain conformation characteristics are common to all breeds. The conformation characteristics discussed here will pertain mainly to the stock horse type. The ideal conformation for the various breeds can be obtained from the breed associations.

A direct relationship has been established between a horse's ability to perform and its conformation. Certain breed and racing associations have defined, to a high degree of correctness, certain measurements of the horse's anatomy which will determine the level it will be physically able to perform a given task. These measurements have been computer-programmed and can be of great assistance in

selecting individuals, especially for breeding purposes. However, for the purpose of individual selection, visual appraisal is necessary.

Transparency No. 1

Before studying conformation and developing a mental picture of the ideal type, it is necessary to know the parts of the horse. Ideal type is the result of an incorporation of the correctly conformed parts. In selecting a horse on conformation a similar procedure to selecting other classes of livestock is used; step 1, side view; step 2, rear view; step 3, front view, step 4, close inspection; and step 5, movement. In the first three steps, the horse is viewed from a distance of about 20 feet. In step four, the animal is inspected up close. The legs should be particularly well inspected for defects or injury. Certain defects such as splints cannot always be seen but can usually be felt by an experienced horserider. In the fifth step, the horse should be observed from the front and rear in a walk and trot. This step is important to see if the animal tracks correctly and if the legs move in a straight line. It should be kept in mind that, in most cases, unless the animal possesses correct conformation, it will not be able to perform at the highest level, regardless how good it is on the basis of other factors.

Transparency No. 2

The first step in establishing ideal stock horse conformation is to determine the total make-up in terms of balance. It is necessary to have a mental picture of the skeletal system of the horse in order to establish the conformation that will constitute correct balance. To achieve its maximum speed immediately from a stopped position, to gather and stop in one or two strides from a dead run, and to turn and roll back instantly, a horse must possess correct balance, which in turn, is the key to the superior performance of the stock horse.

To establish the correct balance and conformation, a horse should be viewed first from the side, since more of the animal can be seen at once. The animal is observed as a whole at a distance of 15 to 20 feet.

Transparency No. 3

Correct Balance in Conformation of the Horse

"Thumb of rule measurements" are easily used in determining whether or not an animal is correctly balanced as shown in this illustration.

The length from the forward-most point of the humerus (point of the shoulder) to the top of the front of the withers (A), the length of the back and loin (B), the length from the point of the hip to the hindmost point of the ischium (at the buttock) (C), and the length from the center of the neck at the point of attachment to the shoulder to the center of the neck at the point of attachment of the head (D) should all be approximately equal. Also, the length of the foreleg from the joint of the humerus and radius to the center of the joint of the cannon and pastern bones (E) should be equal to the length from the top of the withers to the floor of the chest (heart girth) (F). The slope of the shoulder and the pasterns should be equal and approximately 45° . The height at the top of the hip should be approximately equal to the height at the withers, which should be between 58 and 62 inches, or from 14-2 to 15-2 hands.

These "rule of thumb measurements" are accurate in selecting for balanced conformation in the mature animal, although they may give some indication in the immature horse. The depth of the heart girth (F) will not be actual until maturity. However, the other measurements except for height will be proportional after about six months.

This type of skeletal make-up should constitute a basis for conformation which will place the center of balance almost directly behind the front shoulder or the heart girth. This point of balance represents the approximate point at which the rider's weight will be supported. It must be understood that the "rule of thumb measurements" are only an aid in helping determine the balanced conformation of the ideal stock horse type and reflect only the proportionate skeletal make-up of the animal.

Transparency No. 4

Ideal Stock Horse Conformation

After the correctness of balance has been determined, the musculature and shape of the animal are observed.

Sideview: Continuing with the sideview, the feet and legs are examined first, since the utility of the animal is dependent upon their soundness.

The feet should be round and proportionate in size to the animal's body and legs, not too large but not too small. The forearm should be long and the cannon short in length. The joints of the legs should be adequate in size to denote strength. The fore and hind cannon bones should be flat, and the hocks should be low set. The pasterns should be of moderate length. The muscling in the legs should be well developed and defined in the forearm and gaskin and should continue up into the hip and shoulder.

Bunchy muscling as well as too long muscling are undesirable. The legs should fit into the shoulders and the hips, giving the appearance of continuation.

From the side, the shoulder should be well muscled, tapering up into well defined withers. The shoulders should be clean behind as they tie into the body and exhibit a slope of approximately 45°.

The body should appear symmetrical and exhibit a long, well muscled underline, being clean but not cut up in the flank. The back should be short and well muscled through the loin.

As viewed from the side, the rump should appear long and slope gradually from the top to the buttock with a well set tail head. Muscling should be pronounced down through the round and thigh and into the leg with a bulging stifle muscle.

The neck should blend well into the shoulder so that it is carried a little above being straight out from the body. It should be slender and well muscled and clean in the throat hatch.

From the side, the head should be small and blend into the neck so that it appears to belong. The jaw should not be overdeveloped, and the length between the jaw and muzzle should be short. A shallow mouth is ideal with large nostrils. The eyes should be large and set well out on the corner of the head, and the ears should be small.

Frontview: From the front, the animal should stand up well on straight legs. The bone assembly in the front legs should be straight through the knee and fetlocks with no offset or turn in the joints. The legs should fit squarely into the corner of the shoulders. The chest should appear deep and well muscled, exhibiting a good "V" muscle. The appearance of the head should denote intelligence, showing good muscling in the forehead with alert ears and wide set eyes.

Rearview: When viewing the horse from behind, the overall shape of the hindquarters should give the appearance of an apple, with the widest part

being through the stifles. The stifle muscles should be well defined with the hips sloping inward and upward, rounding into the top of the hips. The hind legs should be set wide apart but straight and in the center of each hip, denoting inside and outside muscling of the hips. The gaskin should exhibit long, well defined muscling inside and outside, tying down into low set, clean hocks of ample size.

Transparency No. 5

Conformation Defects of Head, Neck, and Body

After the correct conformation has been established, it is necessary to be able to identify the basic conformation defects:

1. Head:

- a. pig-eyes--small eyes located down on the sides of the head causing inadequate peripheral vision.
- b. Roman nose -- bulge in the bridge of the nose which is unsightly and impairs vision directly in front of the animal.
- c. parrot mouth--lower jaw shorter than upper, making grazing difficult or impossible.

2. Neck:

- a. thick neck and throat latch -- excessive muscle and connective tissue in the neck and throat latch, impairing movement of head and neck and adding extra weight to the front end.
- b. cresty neck - excessive crest of fatty tissue, also impairing movement of head and neck.
- c. ewe neck --caused by improper attachment of neck to shoulder, usually affecting the animal's ability to balance correctly.

3. Body:

- a. straight shoulders--usually constituted by a short scapula and radius and long humerus and cannon bone, causing a short, choppy, rough stride with impaired movement and lack of speed.
- b. mutton withers--usually associated with straight shoulders, making it hard to keep a saddle in place.

- c. long back--usually associated with straight shoulders and short hips, causing a shorter underline and thus a shorter stride.
- d. short hips--usually associated with a long back and straight shoulders and is generally the result of a short tibia and a long femur and rear cannon bone.
- e. weak back and loin--mostly found in long-backed horses and identified by a lack of muscling in these areas.
- f. short couple--identified with a short underline which can cause fouling of forelegs by hind feet.

Transparency No. 6

4. Forelegs and Feet:

- a. splay feet--turning out of feet characterized by a winging movement.
- b. pigeon toes--turning in of feet, constituting a paddling movement.
- c. base wide--associated with narrow chest and characterized by a winging movement.
- d. base narrow--usually associated with forelegs set too far out on shoulders, characterized by a paddling movement.
- e. off in the joints--joining of leg bones at the knees or ankles are offset.
- f. buck knees--over in the knees may result in damaged tendons or knees.
- g. coon feet--associated with long, weak pasterns, constituting a shortened first half of stride and a lengthened last half; may result in tendon or ankle damage.
- h. calf knees--give a pounding gait and hard concussion of feet and knees; may result in damaged knees and feet.
- i. straight pasterns--characterized by a silty action and short stride; may result in foot unsoundness.

Transparency No. 7

5. Hind Legs and Feet:

- a. cycle hocks --constitutes a shortened stride behind and may result in rear feet fouling the fore feet.
- b. post legs--characterized by short, choppy stride with possible damage to hocks and feet.

- c. cow hocks--causes winging movement in back legs and possible damage to hocks and legs by hitting together.
- d. bandy legs--characterized by rolling of the hocks in movement; may affect the animal's ability to gather and turn around.

B. Selection on the Basis of Disposition, Intelligence and Ancestry

Intelligence is probably the most difficult attribute to measure in a horse, especially prior to any training. Although an animal may possess correct conformation, its intelligence and disposition will also influence the level at which it will perform. It has been proven that animals of certain bloodlines consistently out-perform horses of other ancestry with comparable conformation, indicating that intelligence is highly heritable. The ability of parentage to pass on to their offspring an attribute such as intelligence is known as prepotency.

Intelligence and disposition are not synonymous terms; however, they are usually closely related and are often used synonymously by horse people. A horse can be very intelligent but have a bad disposition, but this is the exception rather than the rule. Usually an intelligent horse will exhibit a good disposition.

In considering disposition, two connotations should be discussed. The first is the disposition in terms of docility or gentleness. This is generally evident at an early age. A second connotation is the disposition in terms of try or heart as it is generally called. Some horses will give all they have and are capable of doing, while others with the same abilities will do as little as they can get by with. Both types of disposition are usually influenced and developed mostly through handling and environment. In performance, such as racing, it is very essential that an animal be calm of disposition and have try. In short racing, unless a horse is calm in the starting gates, it will usually be beaten from the start and be unable to recover. Also, the horse must have try, or the heart to win.

Although an animal may inherit a high level of intelligence, it may be masked by the horse's environment--for example, incorrect handling and training. A horse learns by habit or repetition and responds to reward as well as discipline. An animal of superior intelligence may learn quickly but become sour if its trainer should overdo it. This is the point at which the environment might tend to mask intelligence.

Since no reliable method has been developed for assessing a horse's intelligence prior to training, one should use the following as indicators in selecting: (1) check the performance records of the parentage of the animal, their ancestry, and offspring; (2) closely observe the animal's mannerisms, especially the head; the eyes and ears are good indicators of intelligence and disposition (the animal's nature, such as meanness, spookiness, etc. is most easily seen here); (3) if the animal has been trained, then observe the horse's performance and check the reputation of its trainer.

Transparency No. 8

Quarter Horse Pedigree

The bloodline or ancestry of an individual is of more importance possibly in the selection of horses than any other breed of livestock. Although there are outstanding individuals in every bloodline, prepotency is evident in some individuals and not in others. For example; in Quarter Horse racing, Jet Deck was a highly prepotent sire of speed. Not only did he sire speed but he passed this prepotency on to his offspring, as evidenced from the performance of his get recorded on his pedigree. When selecting on pedigree, an individual should become familiar with the various families and bloodlines throughout the various breed associations, stud books, special books and articles on the various bloodlines, and by talking to competent horse handlers.

C. Selection on the Basis of Sex and Age

The sex of an animal will have a direct effect upon its performance. Mares and stallions have proven to be less predictable than geldings in performance. There are exceptions, however, and the predictability of the performance of mares and stallions usually increases with age. Also, mares and stallions are necessary in a breeding operation, and those which exhibit outstanding ability in performance may be very valuable in the stud or as a broodmare.

Though geldings are preferred by most for stock horse performance purposes due to their high level of predictability, they have little value should they become crippled or unable to perform. Most trainers will agree that geldings will maintain a high level of performance longer than mares or stallions as well as being more easily managed.

The age at which a horse is trained and the level of use will usually determine its length of usefulness. The bones of a horse mature around 30 months of age, depending on the horse's level of nutrition. Most horses which are trained after

they have physically matured will remain sound until they are well past twelve years of age under normal use. A high incidence of breakdown, especially in the legs, is noted among two-year-olds that are raced extensively.

D. Selection on the Basis of Performance

The importance of the performance of ancestry has been previously mentioned. The performance of the individual animal is also very important. In most cases, the level of performance can be witnessed. It is very important that the horse's previous training fit the selector's way of riding.

Breed associations maintain records on individuals on the basis of performance in association-sanctioned competition. These performance records are extremely important in determining the value of an animal, especially from the standpoint of breeding stock.

E. Other Points to Consider in Selection

Individual preference of breed or color is important in selection. Although individuals of several breeds may be comparable with the exception of breed or color, an individual will never be as satisfied with a horse of a breed other than his/her preferred breed.

In selecting breeding stock, it is important to look for defects in breeding as well as in conformation. Sterility in stallions and barrenness in mares make them worthless as breeding stock regardless of their worth as performance or halter horses. Timid and slow breeders are also a problem; however, these problems can sometimes be eliminated. It is important for a veterinarian to check breeding stock if they are not well known by the individual.

There are numerous defects which appear in conformation of horses. Some are more serious than others and again the purpose for which the animal is selected has a bearing on the seriousness of the defects. It has been said many times that a horse is only as good as its feet and legs. Regardless of the horse's use, a horse must have sound feet and legs (with the exception of outstanding individuals which have been injured), if it is to be used in breeding programs.

In order to efficiently select horses, an individual must be familiar with the common ailments and lamenesses. Some lamenesses or ailments are hereditary, as are some conformation defects, and are extremely important in selection. Some of the more common ailments and lamenesses of horses are as follows:

Transparency No. 91. Head:

- a. cataract (H)* --cloudy or opaque appearance of the eye.
- b. poll evil -- inflamed swelling of poll between the ears

2. Withers and Shoulders

- a. fistula--inflamed swelling of withers attributed to bruising or brucellosis
- b. sweeny--atrophy or decreased size of a muscle or group of muscles usually of the hip or shoulder

3. Feet and Legs:

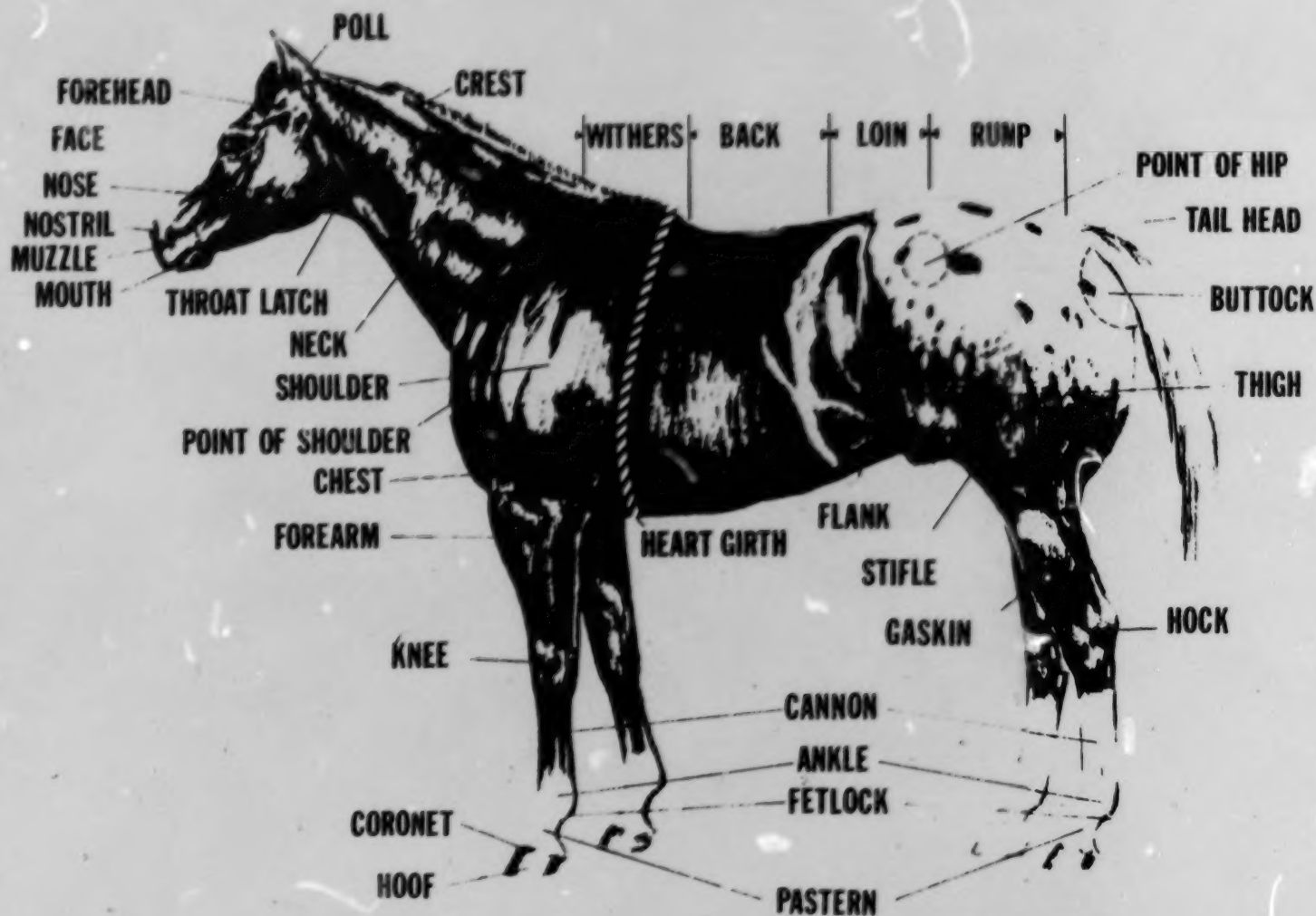
- a. splint -- bone disease, usually on the inside of the front cannon bone, associated with mineral deficiency, strain, faulty conformation or improper shoeing
- b. bowed tendons--enlarged tendons behind the cannon bones
- c. ringbone--bony growth on either or both sides of the pasterns
- d. sidebone--bony growth toward the rear quarter of the hoof head
- e. navicular--inflammation and possible dislocation of navicular bone usually in the front feet
- f. founder--partial or complete separation of hoof due to swelling of feet; caused by overeating, concussion, other diseases, changes in ration, drinking water while too hot; characterized by turning up of hoof, rings in hooves, and various degrees of unsoundness
- g. stifled--displaced patella of stifle joint
- h. bone spavin--bony growth usually found on inside lower point of hock
- i. hipdown--fracture of prominence of hip

4. Body:

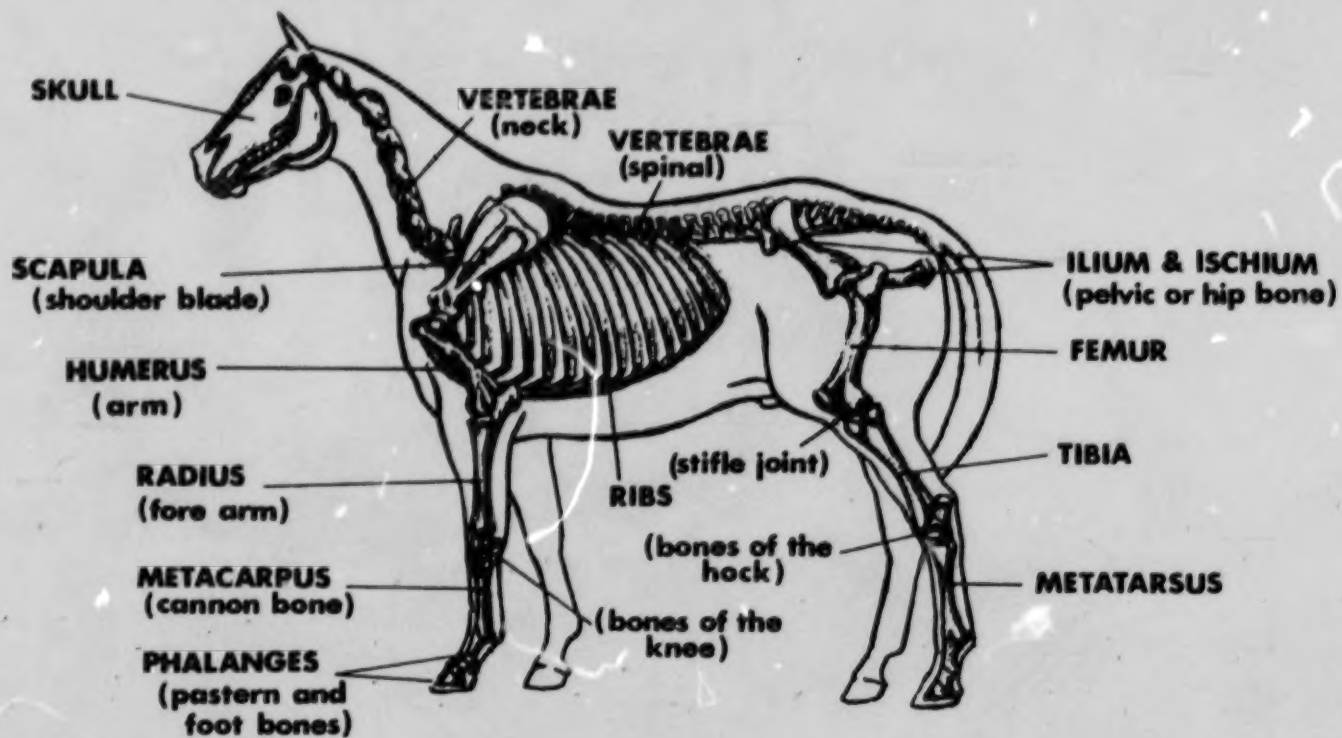
- a. hernia (H)--rupture of umbilical or serotal area allowing internal organs to protrude
- b. heaves--difficult breathing due to lung damage
- c. roaring--difficult breathing due to obstruction usually in the lungs

*(H) indicates a heritable trait.

PARTS OF THE HORSE



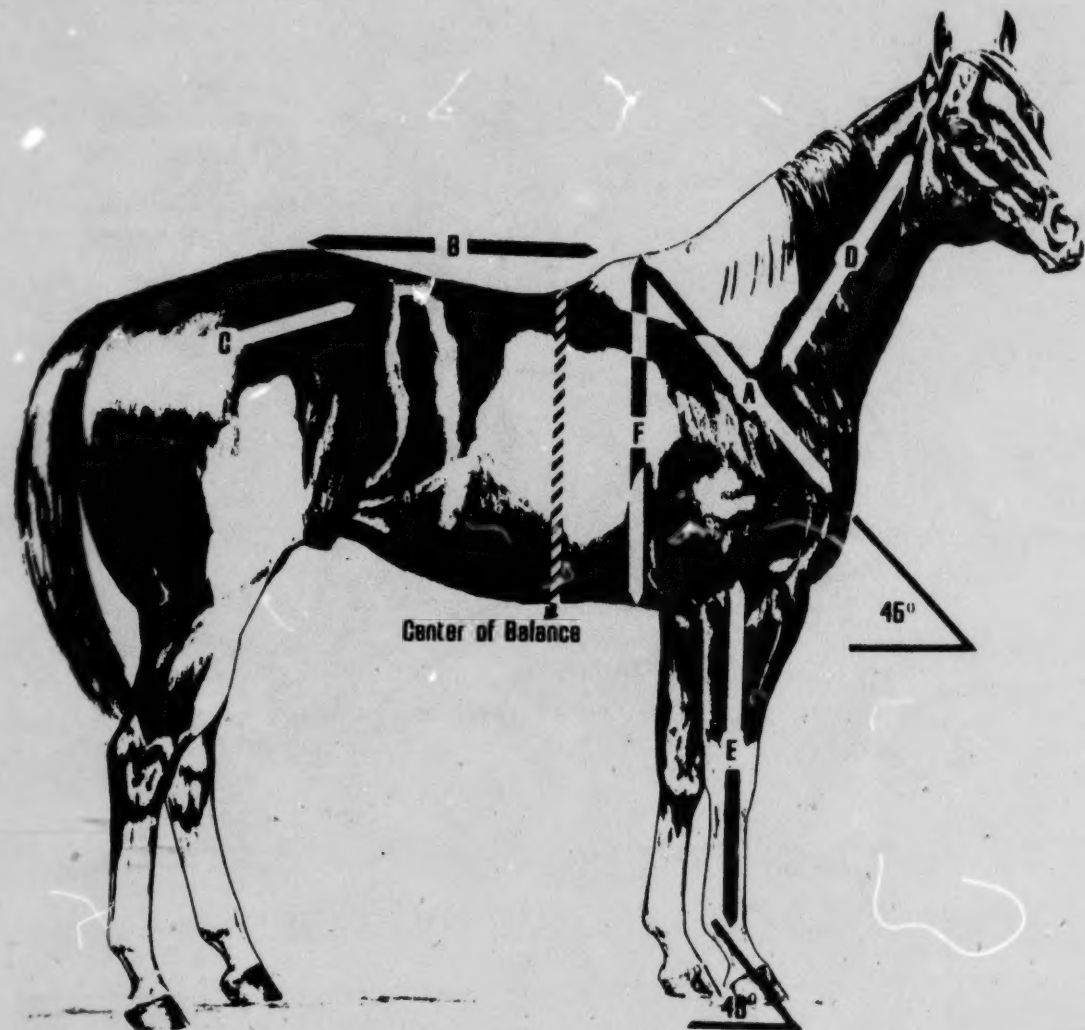
SKELETAL SYSTEM OF THE HORSE



TM-2

AGI-XIII-39

Correct Balance In Conformation



TM-3

AEI-XIII-40

IDEAL STOCK HORSE CONFORMATION



FRONT VIEW



SIDE VIEW



REAR VIEW

TM-4

AGI-XIII-41

COMMON CONFORMATION DEFECTS (head, neck and body)



TM-5

AGI-XIII-42

601

600

COMMON CONFORMATION DEFECTS (front legs)



CORRECT



SPLAY FOOTED



PIGEON TOED



BASE WIDE



BASE NARROW



OFF IN THE JOINTS



CORRECT



OVER SHAFTED
AND COWN FOOTED



CROOK ANGLED AND
STANDING POSITIONAL

COMMON CONFORMATION DEFECTS (hind legs)



CORRECT



SICKLE HOCKED



POST LEGGED



CORRECT



COW HOCKED

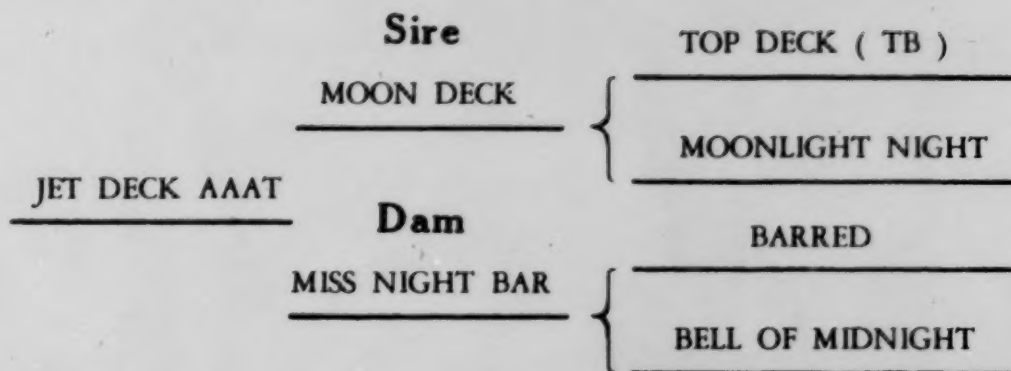


BANDY LEGGED

TM-5

AGI-XIII-44

QUARTER HORSE PEDIGREE



1960 Bay Stallion

RACING RECORD:

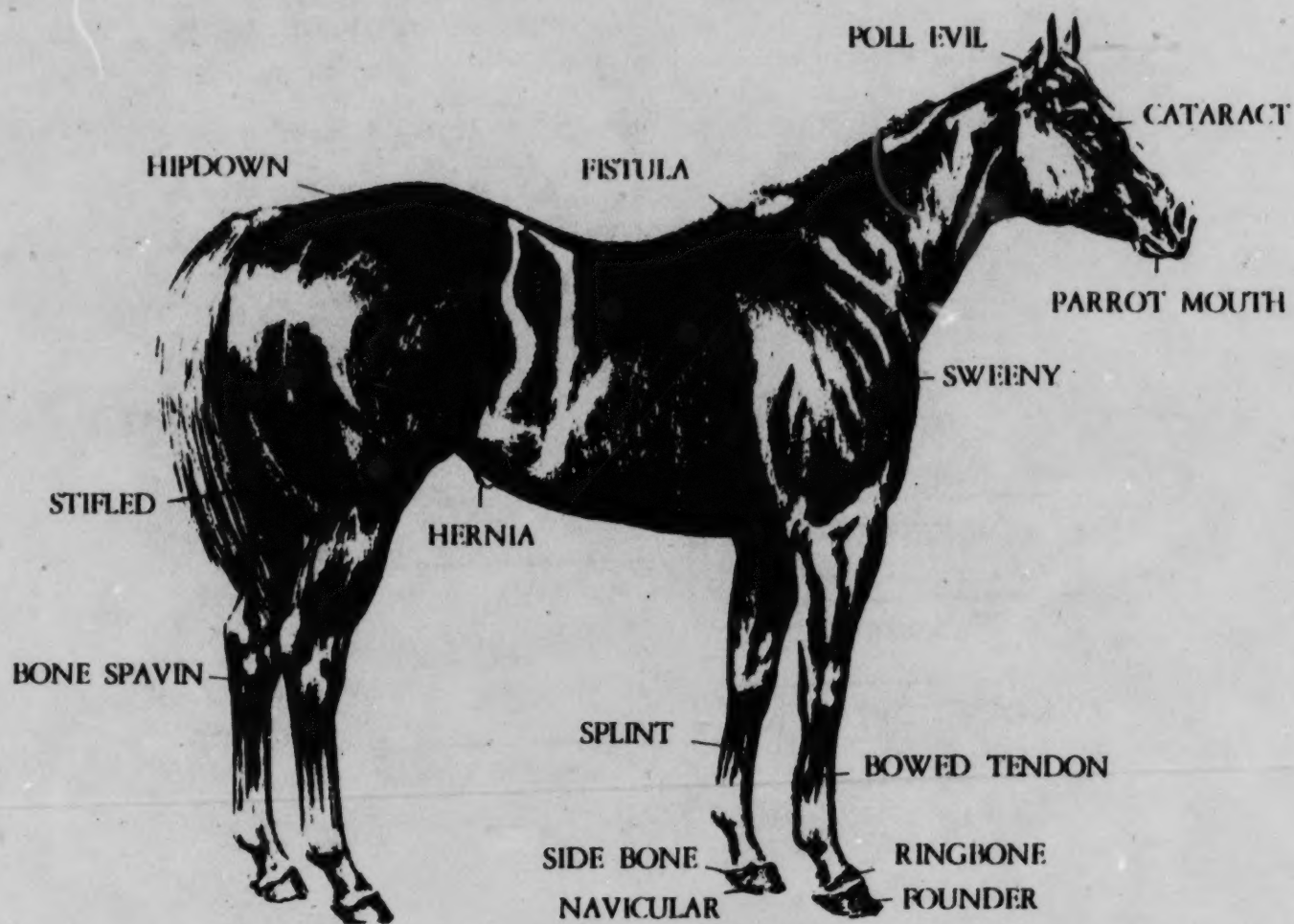
1962 - Champion Stallion, Champion Two Year-old Colt

1963 - World Champion Quarter Running Horse, Champion Stallion,
Champion Three Year-old Colt

31 starts, earned \$ 200,625 and 42 racing points: 22 wins, 4 seconds, 2 thirds

In 1970, at the time of his death, he had sired 114 ROM qualifiers, 22 AAAT,
50 AAA, and 42 AA

COMMON AILMENTS AND LAMENESSES of the horse

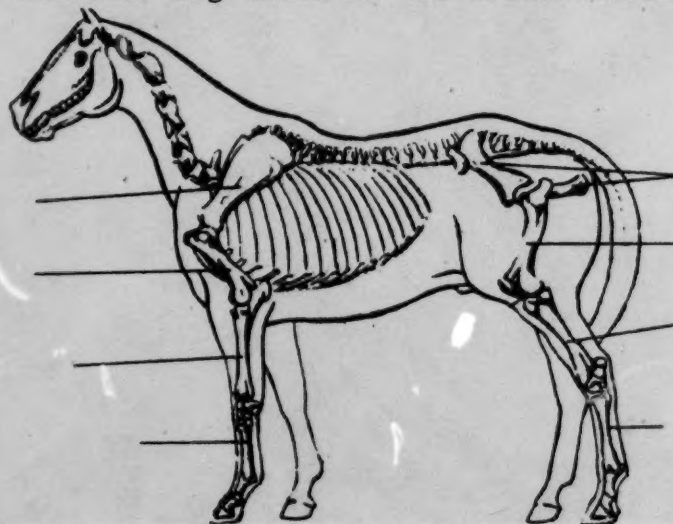


TM-6

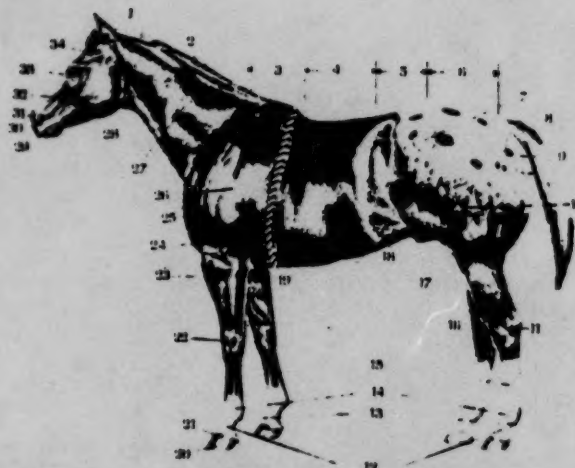
AGI-XIII-46

SELECTED STUDENT ACTIVITIES

1. Describe in your own words what constitutes correct balance in Stock Horse conformation.
2. Label the four major bones of (a) front leg and shoulder and (b) hip and rear leg shown in the illustration below.



3. List the parts of the horse as identified on the animal below



- | | |
|-----|-----|
| 1. | 19. |
| 2. | 20. |
| 3. | 21. |
| 4. | 22. |
| 5. | 23. |
| 6. | 24. |
| 7. | 25. |
| 8. | 26. |
| 9. | 27. |
| 10. | 28. |
| 11. | 29. |
| 12. | 30. |
| 13. | 31. |
| 14. | 32. |
| 15. | 33. |
| 16. | 34. |
| 17. | 35. |
| 18. | |

4. Using the thumb rule measurements for determining balance, describe the correctness of balance of the two animals below.



A.



B.

5. In your own words describe the ideal conformation of the stock horse type.

Sideview:

611

Frontview:

Rearview:

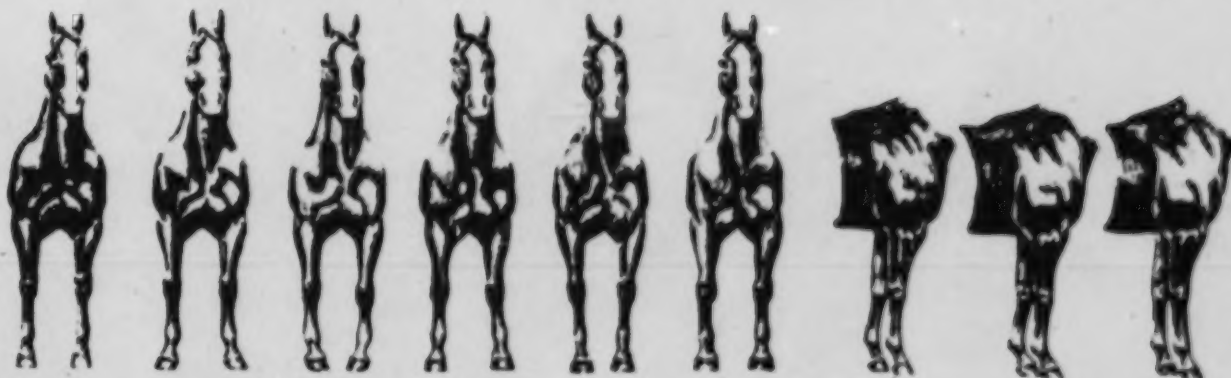
6. Identify the conformation defects on the animals below.

AgI-XIII-49

A. Head, neck and body:



B. Front legs and feet:



C. Hind legs and feet:



7. Identify the common ailments and lamenesses as shown on the animal below.



1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

8. Describe seven factors other than conformation which are of importance in the selection of the ideal stock horse.

1.

2.

3.

4.

5.

6.

7.

Local Adaption --- Animal Science

Goat Breeds

Instructor's Guide

1. This unit is an animal science local adaption unit which is to be used if goat production is of economic importance in the region served by your vocational agriculture program.
2. Have students write to the breed associations to gather information.
3. Have students report their findings.
4. Take a field trip to see different breeds.
5. Use slide sets of breeds to identify breed traits. Slides available from Vocational Instructional Service, Texas A & M University, F.E. Box 182, College Station, Texas 77843.

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the breed associations.
3. Compare the advantages and disadvantages of the breeds.
4. Select the breeds most suited to their location and desires.
5. Understand and be able to use terms common to the goat industry.
6. Identify major breeds of goats.
7. List the physical traits and production characteristics of major breeds of goats.

References

1. Gillespie, James R., Modern Livestock and Poultry Production, 1981, Delmar.
2. Ensminger, M.E., The Stockman's Handbook, 5th edition, 1978, Interstate.
3. Student Manuals on Goat productions from Texas A & M and/or Illinois.
4. Oregon 4-H Handbooks on Goat production.

Teaching Aids

1. Overhead transparencies.
2. Pictures of breeds of goats.

3. Breed association publications.
4. Slides of goat breeds.

Students Activities

1. Fill out breed information sheet.
2. Take field trip to see breeds of goats.
3. Students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Glossary of Terms

Buck - mature male goat.

Cabrillo - the name given by Mexicans to the meat of a young Spanish goat.

Chevon - the meat of an Angora goat.

Crossbred - an animal resulting from the mating of two different breeds.

Doe (goat) - a female Angora or Spanish goat.

Fertility - capable of breeding or reproducing.

"Full blood" - a term used by some people when referring to purebred animals.

Kid - a young goat under one year of age.

Mutton - a goat over one year of age that was castrated while a lamb.

Spanish goat - a goat brought to this country by the Spanish explorers; it was used for milk and meat.

Name _____

[illegible]

AR 1-214-4

619

Breeds of Goats

*Terms: All terms underlined are included in the "Glossary of Terms."

Note: A 2" x 2" slide set, "Breeds of Sheep and Goats," is available from Vocational Instructional Services, Texas

1. Importance of Milk Goats

Goats were one of the first animals domesticated. According to the Old Testament, the goat--a very versatile animal--furnished milk, meat, and clothing; and its skin was used to make containers. Ancient, wandering tribes moved their goats with them so as to insure a constant supply of food. Many people in the world prefer goat's milk to other milk. When the late Mahatma Ghandi of India visited England, he took along two milk goats to provide milk.

The first milk goats introduced into the U.S. were brought over from Europe by the settlers of the Virginia colonies.

Because of goat milk's fine, soft curd, it is more easily digested than cow's milk; however, according to W.R. Steffen in an article in the American Journal of Veterinary Medicine, the chemical analysis of goat's milk is similar to that of cow's milk, with the percentage of butterfat and other elements being about the same.

Good management is required to produce quality goat milk.

The average milk goat produces about two quarts of milk per day; however, many goats exceed this production. Some milk goats on official tests have produced as much as 4,600 pounds of milk in a 10 month's lactation.

1. Importance of Angora Goats

Located on a high plateau that varies from one to four thousand feet above sea level, the Angora province in Turkey was the origin of the Angora goat and is the area for which the Angora goat was named.

In 1881, the Sultan of Turkey, recognizing the value of the lustrous fiber produced by the Angora goat, passed an edict prohibiting the exportation of the Angora goat from his country. His purpose was to confine the production of mohair to Asia Minor, thereby giving his country a monopoly of the mohair trade.

Dr. James B. Davis of South Carolina introduced the first Angora goats into this country in 1849, which was thrity-two years before the Sultan's edict. The breeding of a few imported Angora goats to Spanish goats, which were brought to this country by Spanish explorers, furnished the foundation of the great goat and mohair industry in the U.S. today. To develop the Angora goat, Angora bucks were bred to Spanish does; and in a period of five generations were considered to be "full bloods."

Mohair, the wonder fiber produced by the Angora Goat, is used to make fine fabrics for clothing, upholstery, drapes, and carpets. The fiber is very durable, dyes brilliantly, and retains color well.

Angora goat meat, called chevon, is used in a blend with other goat meats to produce several meat products sold by packing plants. Also, the meat of Angora goat kids and Spanish goat kids, called cabrito is preferred by many people.

Nearly 50 percent of the world's mohair, and 97 percent of the U.S. clip, is produced in Texas.

BREED

ORIGIN

CHARACTERISTICS

A. Breeds of Dairy Goats

French-Alpine

A. The French Alps

1. Color..... a. No Standard color

B. Imported in 1922

2. Size..... Large, rangy
(1) Buck- 165-170 lbs.
(2) Doe- 120-135 lbs.3. Production..... a. Butterfat - 4.0%
b. Milk - 1,500-1600 lbs.4. Other..... a. Ears are medium sized and
errect.
b. Short haired
c. Males have a pronounced
beard.
d. Some are horned.

Nubian

A. Nile Valley Nubia

1. Color..... a. Black and white, tan and
white, red and white.

B. Imported in 1900

2. Size..... a. Bucks- 150 lbs.
b. Does - 100 lbs.3. Production..... a. Butterfat - 5.02%
b. Milk - 1,300-1,500 lbs.4. Other..... a. Long, pendulous ears hang
close to head.
b. Roman nose
c. Always shorthaired

Saanen

A. Saanen Valley,
Switzerland

1. Color..... a. White or creamy white

B. Imported by U.S.
D.A. in 18692. Size..... a. Buck - 160-185 lbs.
b. Doe - 120-135 lbs.3. Production..... a. Milk - 1,800-2,000 lbs.
b. Butterfat - 3.59%

BREED

ORIGIN

CHARACTERISTICS

Saanen (Continued)

4. Other..... a. Ears point upward and forward.
b. Straight or slightly dished face
c. No wattles
d. Doe-bearded

Toggenburg

A. Toggenburg Valley,
Switzerland

B. Introduction into
Ohio in 1893

1. Color..... a. Brown body
b. Two white strips on face,
white on legs below knees
2. Size..... Smallest breed of dairy goat
a. Buck- 150-160 lbs.
b. Doe - 100-120 lbs.
3. Production..... a. Milk - 1,500 - 1,600 lbs.
b. Butterfat - 3.18%
4. Other..... a. Ears are erect and point forward.
b. Hair coat is short and very fine.
c. Wattles
d. Hardy and versatile

The Angora Goat

Angora

A. Imported from Angora,
Turkey and South Africa

1. Color..... a. White
b. Other colors undesirable
2. Size..... Small as compared to milk goats
(1) Buck- 125-175 lbs.
(2) Doe- 80-90 lbs.
3. Production..... a. 4-10 lbs. mohair per year
b. One or two kids annually
c. Mutton characteristics are not considered as important as mohair.

AGI-XIV-8

BREED

ORIGIN

CHARACTERISTICS

Angora (Continued)

5. Very adaptable to agricultural areas such as
Edwards Plateau.

626

627

BREED ASSOCIATIONS

American Dairy Goat Association
c/o Don Wilson
PO Box 865
Spindale, NC 28160

American Angora Goat Breeders Association
c/o T.C. Taylor
Rockspring, TX 78880

American Goat Society, Inc.
c/o Wayne Hamrick
1606 Colorado St.
Manhattan, Kansas 66502

SWINE BREEDS

Instructor's Guide

1. This unit has three sections: Breed Identification, Basic Management, and Selection. These three units may be taught or livestock skills may be added (castration, teeth clipping, etc.) Note that livestock skills are planned to be covered in the AgII Guide.
2. Have students write to the Breed Association to gather information.
3. Have students report their findings.
4. Hand out rules of thumb, terms and definition sheets.
5. Take a field trip to see different breeds, and for swine selection.
6. Use slide sets of breeds to identify breed traits. Slide sets are available from the following sources:
 - a. Vocational Instructional Materials
Texas A & M University
F.E. Box 182
College Station, Texas 77843
 - b. Vocational Agricultural Service
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801

OBJECTIVES

Upon completion of this unit the student will be able to:

1. Write to a breed association of their choice requesting information.
2. Orally report their findings from the Breed Association.
3. Compare the advantages and disadvantages of the breeds.
4. Select the breeds most suited to their location and select individual animals based on conformation.
5. Understand and be able to use terms common to the swine industry.
6. Identify major breeds of swine.
7. List the physical traits and production characteristics of major breeds of swine.
8. Understand basic management concepts which apply to swine production.

References

1. Oregon Pork Producers Handbook, OSU Extension Service, 1980, OSU, Corvallis 97331.
2. Gillette, James N., Modern Livestock & Poultry Production, 1981, Delmar.
3. Ensminger, W. E., The Stockman's Handbook, 1978, Interstate.
4. Student Manual on Swine breeds and selection.
5. Instructional materials from Illinois on swine breeds and selection.

Teaching Aids

1. Overhead projector with transparencies.
2. Pictures of breeds of swine.
3. Breed Association publications.
4. Slides of swine breeds.

Student Activities

1. Fill out breed information sheet.
2. Take a field trip to identify common breeds of swine.
3. Have students give oral reports on the breed of their choice.
4. Have students identify breed traits from live animals or slides.

Glossary of Terms

Barrow - male hog that has been castrated while quite young.

Boar - male hog of breeding age.

Castration - removal of the testicles, or sex glands, of the male.

Cross bred - an animal whose sire and dam are of different breeds.

Dressing percentage - weight of the carcass of an animal expressed as a percentage of the living weight.

Farrow - act of sow giving birth to young pigs.

Gestation period - the period between breeding of the female and birth of the offspring.

Gilt - young female pig which has not produced young.

Grade animal - usually applies to any animal which is not purebred.

Heterosis - an obvious vigor or capacity for growth often shown by crossbred animals.

Hog - an American term applying to mature swine of either sex.

Hybrid - an animal produced from the crossing or mating of two animals of different breeds.

Hybrid vigor - vigor usually possessed by hybrid animals.

In-breeding - the mating of very closely related animals as full brother and sister.

Lactation - period female animal gives milk.

Line-breeding - the mating of animals that are related but which are not as close as brother and sister.

Litter - multiple young born at the same time, also refers to material used for bedding.

Longevity - length of life, a long duration of life.

Meat-type hog - a well muscled hog that has good length of body and an above average percentage of ham, loin, and shoulder.

Mongrel - an animal of nondescript or mixed breeding.

Parturition - the act of giving birth to young, applies to all animals.

Pedigree - a written record of an individual animals' parentage and ancestry.

Performance record - the evaluation of an animal's production based on several factors; factors may be number of pigs weaned, birth weight, weaning weight, etc.

Porcine - genus name for swine.

Pure-bred - an animal carrying only the blood of some one breed.

Scrotum - the pouch of skin containing the testicles of the male animal.

Sow - female pig that has produced a litter.

Swine - pigs.

Weaner - young pig that no longer relies on the sow's milk for nourishment.

BREEDS

Name _____

BREED	PLACE OF ORIGIN	COLOR	DISTINCTIVE HEAD CHARACTERISTICS	OTHER DISTINGUISH- ING CHARACTERISTICS	REASON TO BUY THE BREED ADVANTAGES &/OR DISADVANTAGES
	633				634

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,689	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	19,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,674
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*

TOTAL CROSS FARM SALES	1,742,337	1,494,437	1,253,984
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p - Preliminary r - Revised

*Includes nursery crops and turf sod.

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1960 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
thousand dollars															
THE STATE....	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,056	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,683	1,225	2,884	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,018	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,334	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	189,598
Multnomah..	631	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,628	1,118	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington.	8,641	2,740	3,135	974	7,344	6,696	3,890	24,070	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,242	1,679	3,247	227	7,637	835	4,413	9,228	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Coos.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry.....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook..	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,996	6,890	45,874	86,681
Douglas....	2,210	734	77	66	2,470	374	1,086	8,750	15,767	11,234	1,050	687	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,009	38,735
Josephine..	56	439	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,489	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	390,246
Gilliam....	20,227	199	226	108	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Hood River.	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Morrow....	40,671	12,894	72	27,270	63	---	---	3,020	83,990	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla...	83,314	6,121	794	19,921	12,237	106	12,167	2,700	137,360	24,008	419	5	5,881	30,313	167,673
Wasco.....	17,120	1,694	---	304	8,950	---	104	600	28,772	6,247	---	---	935	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,687	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,892	2,448	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,108
Wallowa....	6,241	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,024	43,188	6,143	34,111	294	---	708	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	124	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,884
Deschutes..	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Harney....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	26,392
Jefferson...	6,772	2,689	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,351	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,080	682	1,960	36,822	83,619
Lake.....	1,431	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,735	27,397

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1960

INFLATION
1979 GROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All live stock & products	TOTAL GROSS INCOME
THE STATE...	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,247	588,328	1,494,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,253
Benton....	3,870	386	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas..	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,948	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,860	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah..	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,002	1,823	12,443	44,495
Washington.	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,891	71,492	93,958
Clatsop....	---	43	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,886	4,744	6,834
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	24,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook..	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	994	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,617	33,091
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,536	37,380
Josephine..	43	368	---	894	244	---	90	2,908	4,627	2,385	5,396	257	583	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River..	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,610	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	56	---	162	34	---	---	---	14,369	2,579	---	1,407	732	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,447	1,370	36	176	10	---	---	850	4,889	18,354	2,068	3	764	21,191	26,080
Malheur....	13,424	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	600	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa...	3,487	1,521	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,840
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	384	12,089	18,364
Deschutes..	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,946
Jefferson..	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,144

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

Breeds of Swine

*Terms: All terms underlined are included in the "Glossary of Terms."

Note: A revised slide set, "Breeds of Swine" is available from Vocational Instructional Service, Texas.

I. Introduction

Swine production has become a highly scientific and specialized business in American agriculture. Although hogs are still raised as a supplemental source of income under free range and scavenger types of conditions on many farms, this constitutes only a small percentage of the total swine enterprise. Today, hogs are bred, raised, and fed under extremely controlled conditions.

From the early colonial days through the late 19th century, pork was produced mainly for consumption by the family, and the lard was used for various purposes, such as cooking and soap making. Although hogs were raised and sold for commercial purposes in some areas and even exported as early as 1790, this was due to the lack of refrigeration and processing facilities. Hogs were mostly slaughtered during the cold months, and smoke houses were the major means of preservation. With the initiation of mechanical cooling in the late 1800's and refrigerated railroad cars, pork slaughter and processing became a year around business.

Today the United States ranks high among the nations of the world in total hog numbers and is one of the leading countries in exportation of pork and pork products.

Hogs rank as one of the most important sources of farm income. The consumption of pork in the United States is higher than in any other country of the world with the per capita consumption averaging about 65 pounds. In 1980, Oregon pork producers grossed \$14,524,000.

Individual excellence of animals is important and should be stressed in establishing and maintaining a herd, particularly if the objective is to produce and sell breeding stock. Today, the long, upstanding lean, non-wasty, but heavily muscled type of hog meets the ideal. Highly controlled selection and breeding programs within breeds, and specialized crossbreeding programs have put the swine industry near the top in production among the various livestock enterprises. Swine have the highest feed conversion efficiency ratio of large farm animals (chickens are highest of all farm animals).

The selection of a breed is largely a matter of personal preference. No one breed is perfect in every respect. Choose a breed of the type and color desired and one that seems to be suited to the conditions under which the hogs are to be raised.

The breeds of hogs that will be discussed could be grouped into the following two categories:

Old Established Breeds

Berkshire
Chester White
Duroc
Hampshire
Hereford
Poland China
Spotted Poland China
Tamworth
Yorkshire

New Breeds

American Landrace
Ohio Improved Chester
Inbreds

In becoming acquainted with these breeds of hogs, it will be interesting to note that with the exception of the American Landrace, Berkshire, Tamworth, and Yorkshire, the breeds of swine common to the United States are strictly American creations.

11. Breeds of Swine

BREEDS	ORIGIN	CHARACTERISTICS
A. Old Established Breeds		
1. Berkshire	A. Originated in Berkshire, England	(1) Color.....Black with white feet, face, and tip of tail
	B. Imported to the United States in 1823	(2) Erect ears
		(3) Size.....(a) Smaller than some of the breeds (b) Average mature weight Male: 450-650 lbs. Female: 400-550 lbs.
		(4) The snout is short and turned up.
		(5) In conformation and fleshing, the Berkshire generally conforms to the ideal <u>meat-type</u> <u>hog</u> .
2. Chester White	A. New England States from the Jersey Reds, red Durocs, and red Berkshires	(1) Color.....Red, varying from a golden yellow to a deep red. Black flecks may appear but spots are objectionable.
	B. Breed standard set in 1885	(2) Drooping ears
		(3) Size.....(a) Large, excellent feeding capacity (b) Average Mature Weight: Male: 500-750 lbs. Female: 450-650 lbs.
		(4) In type and conformation, produce a very desirable carcass
		(5) Sows are <u>prolific</u> and have good mothering ability.

BREEDS	ORIGIN	CHARACTERISTICS
3. Duroc	A. New England States	(1) Color.....Red, varying from a golden yellow to a deep red. Black flecks may appear but spots are objectionable.
		(2) Drooping ears
	B. Breed standard set in 1885	(3) Size.....(a) Large, excellent feeding capacity (b) Average Mature Weight: Male: 500-750 lbs. Female: 450-650 lbs.
		(4) In type and conformation, produce a very desirable carcass
		(5) Sows are <u>prolific</u> and have good mothering ability.
4. Hampshire	1. Developed by R. U. Webber of La Plata, Missouri, about 1900	(1) Color.....Markings resemble that of Hereford cattle; red body color with white face, underline, legs, and switch of tail. Darker shades of red are preferred.
	2. Developed from parent stock of Duroc, Chester White, and OIC breeding	(2) Drooping ears
		(3) Size.....(a) Medium sized (b) Average mature weight Male: 800 lbs. Female: 600 lbs.
		(4) Sows are prolific and possess good mothering ability.
		(5) Criticized for lacking style and quality of other breeds

BREEDS	ORIGIN	CHARACTERISTICS
6. Poland China	A. Originated in the Miami Valley region of Ohio in early 1800's B. Originated for the purpose of converting corn into pork, and became the first lard-type hog C. Percent stock included the white Byfield hog imported from Russia, the big China hog from Philadelphia, the Berkshire, and the Irish Grazer from Ireland along with native hogs from the area	(1) Color.....Black with blazed white face, white feet, white tip of tail (2) Drooping ears (3) Size.....(a) Very large and upstanding (b) Average Mature Weight: Male: 550-800 lbs. Female: 500-650 lbs. (4) Exhibit good length and good hams (5) Produce highly desirable carcasses
7. Spotted Poland China	A. Same origin as the Poland China B. In the development, the spotted hogs were selected and maintained and differed significantly from the Poland China only in color.	(1) Color.....Black and white spotted consisting of 20-80% (2) Drooping ears (3) Size.....Same as Poland China (4) Resembles the Poland China in conformation and type (5) Good feeders

BREEDS	ORIGIN	CHARACTERISTICS
8. Tamworth	A. Originated in England	(1) Color.....Red, varying from light to dark
	B. First imported in 1881	(2) Erect ears
	C. One of oldest breeds of hogs	(3) Size.....(a) Medium size, long body (b) Average Mature Weight: Male: 500-650 lbs. Female: 400-550 lbs.
	D. Originally developed as a bacon-type hog	(4) Characterized by along, narrow body; a long, narrow head; and a long snout (5) Sows are prolific, make good mothers, and are good foragers
9. Yorkshire	A. Originated in England; know as the "Large White"	(1) Color.....White, with occasional black pigment spots in the skin
	B. Imported in 1893 to Minnesota	(2) Erect ears; slightly dished face (3) Size.....(a) Large, long bodied, large boned, and framed (b) Average Mature Weight: Male: 500-750 lbs. Female: 450-650 lbs.

B. New Breeds		
1. American Landrace	A. Originated in Denmark	(1) Color.....White; small black spots on the skin are common
	B. First important in 1934 for experimental crossbreed purposes	(2) Large, drooping ears (3) Size.....(a) Long bodies, large framed

BREEDS

ORIGIN

CHARACTERISTICS

American Landrace (continued)

C. Not recorded as
purebred until
1949 when Danish
government controls
were released

(b) Average Mature Weight:
Male: 500-700 lbs.
Female: 450-600 lbs.

- (4) Other distinguishing characteristics include a flatter back, a straight snout and trim jaw
- (5) Sows are prolific and noted for good mothering ability
- (6) Noted for efficient feed utilization and meaty carcass

2. Ohio Improved
Chester
(O.I.C.)

A. Originated in Ohio

B. Developed from
White Chesters

- (1) Color.....White hair and skin; small spots may appear on the skin, although this is not desirable

(2) Slightly drooping ears

- (3) Size.....(a) Very large
(b) Average Mature Weight:
Male: 550-800 lbs.
Female: 500-650 lbs.

(4) Other distinguishing characteristics include a wide, short head with a slightly dished face

(5) Sows are considered as good mothers and milkers

Breeds of Swine (continued)

3. Inbreds--As a result of swine breeding research at State and Federal experiment stations, a number of inbred lines have been developed from crosses of two or more breeds. The purpose of crossbreeding was to increase growth rate, vigor, and productiveness through heterosis or hybrid vigor. The hybrid is the product of the crossing of two purebreds usually from different breeds. These crossbred or hybrid females generally produce and raise larger litters than parent breeds, and the offspring are more vigorous and make faster gains. These crosses are then inbred, and animals from these inbred lines have been admitted for registry in various associations. The new breeds of swine developed from inbred lines are shown in Table 1.

Table 1: NEW BREEDS OF SWINE DEVELOPED FROM INBRED LINES

<u>Breed</u>	<u>Parent Stock</u>	<u>Color</u>
Beltsville No. 1	74% Landrace 26% Poland China	Black and white spots
Beltsville No. 2	58% Yorkshire 30% Duroc 6% Landrace 6% Hampshire	Light red
CPF	Beltsville No. 1 San Pierre	Black and white
CPF No. 2	25% Beltsville No. 1 50% Maryland No. 1 25% Yorkshire	Black and white
Maryland No. 1	38% Berkshire 62% Landrace	Black and white spotted
Minnesota No. 1	45% Tamworth 55% Landrace	Red
Minnesota No. 2	40% Yorkshire 60% Poland China	Black with white spots
Minnesota No. 3	Gloucester Old Spot Welch Pig English Large White Beltsville No. 2 and others	Red
Montana No. 1	45% Hampshire 55% Landrace	Black

Breeds of Swine (continued)

Table 1: NEW BREEDS OF SWINE DEVELOPED FROM INBRED LINES

<u>Breed</u>	<u>Parent Stock</u>	<u>Color</u>
Palouse	Chester White Landrace	Black
San Pierre	Berkshire Chester White	Black and white

BREED REGISTRY ADDRESSES

American Berkshire Association
601 W. Monroe Street
Springfield, IL 62704

American Landrace Association
c/o Steven Morrissey
P.O. Box 647
Lebanon, IN 46052

American Yorkshire Club
Box 2417
Lafayette, IN 47902

Chester White Swine Record Association
817 East Ninth Street
Box 228
Rochester, IN 46975

Hampshire Swine Registry
1111 Main Street
Peoria, IL 61606

Inbred Livestock Registry Association
Route 4, Box 207-A
Noblesville, IN 46060

National Hereford Hog Record Association
c/o Ruby Schrecengast
RR 1
Flandreau, SD 57028

National Spotted Swine Record
c/o Bill Newham, Secretary
110 Main
Bainbridge, IN 46105

Ohio Improved Chester Swine Breeders Association
c/o T. R. Hendricks
RR 2 Box 166
Cloverdale, IN 46120

Poland China Record Association
c/o Don Nickodim
P.O. Box 71
Galesburg, IL 61401

Breed Registry Addresses
(Continued)

Tamworth Swine Association
Rural Route 2 Box 126A
Hillsboro, OH 45133

Unit J Duroc Swine Registry
1803 W. Detweiller
Peoria, IL 61614

SELECTED STUDENT ACTIVITIES

1. Of all the breeds of swine studied, which four were imported to the United States?
 - a. _____
 - b. _____
 - c. _____
 - d. _____
2. List the names of the purebred breeds of hogs which are found in your locality.
3. Of the "New Breeds" listed in Table 1, which breed was developed from the largest number of parent stock? Give the percentages.
4. What advantage is generally gained in the development of the new hybrid lines of hogs?
5. If one's objective is to produce and sell breeding stock, what factor should be stressed in establishing the herd?
6. What country has the highest rate of consumption of pork?
7. Select the breed of your choice and write the breed registry association for additional information.
8. Write the name of the breed of swine in the space that is provided for each description given below.

_____ Intermediate in size, white hair and skin with occasional freckles, and a drooping ear

_____ Long bodied, white hair and skin with small black spots being common, and very large slightly drooping ears

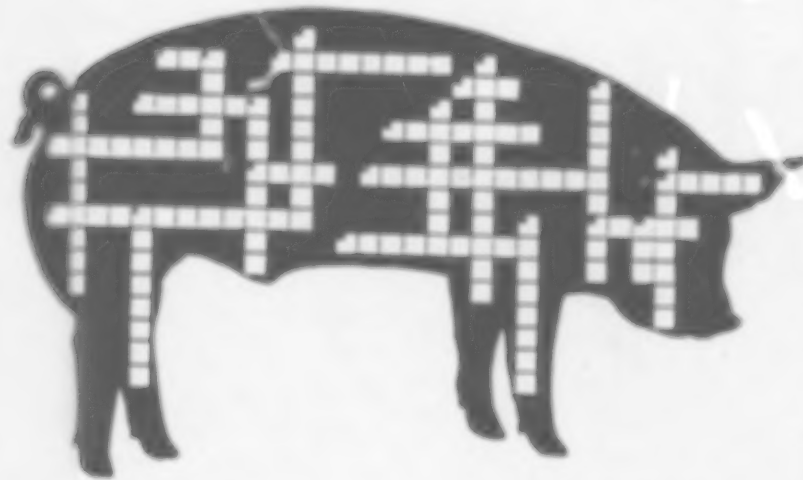
_____ A large breed of white hogs imported from England and characterized by erect ears

_____ A large breed of white hogs developed in Ohio and characterized by slightly drooping ears

SELECTED STUDENT ACTIVITIES (Continued)

- _____ A large breed of red hogs with drooping ears and recognized for their mothering ability and carcass conformation
- _____ Intermediate in size, red in color, and characterized by a long, narrow body and erect ears
- _____ A breed developed in Missouri from parent stock of Duroc, Chester White, and OIC breeding with a red body color and white markings
- _____ A medium sized breed identified by black body color with white markings on the face, feet, and tail and a short, turned up snout
- _____ A large breed of hogs identified by black body color with white markings on the face, feet, and tail and a drooping ear
- _____ A black breed of hogs with a white band around the body at the shoulder and having erect ears
- _____ A large breed of mixed black and white spotted hogs developed in Ohio and selected for their color
- _____ Breeds of hogs resulting from line crosses of two or more established breeds

SELECTED STUDENT ACTIVITIES (Continued)



9. Cross Word Puzzle

ACROSS:

1. Abundant reproduction
3. A breed characterized by white hair and skin and drooping ears
5. Results of crossing two animals of different breeds
7. Color of the Duroc breed
9. A breed characterized by white hair, a long body, a straight snout, and large drooping ears
11. State in which the OIC breed was developed
13. A mature female swine
15. Because of agreement with the _____ government, the Landrace breed could not be recorded in this country until 1949.
17. Extra growth capacity gained in crossbreeding
19. A white breed of hogs with a slightly dishd face and erect ears
21. Common name for the Spotted Poland China breed
23. Ear characteristic of the Yorkshire breed

DOWN:

2. The snout is short and turned up.
4. A breed originally developed as a bacon-type hog
6. Ear characteristic of the Landrace breed
8. A breed that can be identified by red color and drooping ears
10. Black with a white band around the body.
12. Black with six white points
14. New breeds of swine developed from crosses of two or more breeds
16. Red and white color marking resembling a breed of cattle

Cross Word Puzzle (continued)

- 18. A term used to describe the hybrid vigor shown by crossbred animals
- 20. Ohio Improved Chester
- 22. An ideal hog with good muscling, good length of body, and above average percentage of ham, loin, and shoulder

Instructor's Guide

Swine Management Information

The following information would be helpful to freshman students as a basis to begin their swine projects. This information should be made available to all students to aid them with their projects. It is not a complete management unit; however, it does contain important basic facts and rules of thumb.

SWINE THUMB RULESFEEDS AND FEEDINGFattening pigs:

1 lb. salt/100 lbs. of entire ration
 3-4 lbs. concentrate/day/100 lbs. live weight
 no need to feed hay

Gilts and sows:

feed gilts 1-3/4 to 2 lbs. grain/day/100 lbs. live weight
 feed sows 1-3/4 lbs. grain/day/100 lbs. live weight

It takes approximately 350-400 lbs. of concentrate to produce 100 lbs. por. Improved feeding and management practices can reduce this 15%-20%.

Daily water requirements for swine: 12 lbs/100 lbs. live weight at weaning to 4 lbs/100 lbs. live weight at fattening.

Grain (corn, wheat, barley) should always be supplemented with a protein supplement, salt, minerals, and vitamins. Never feed grain without proper supplementation.

BREEDING

Well grown boars are sexually mature at 6-7 months and can be reliable breeders at 10 months at which time they can be allotted 15-20 sows. Older boars may be allotted twice this many sows for the breeding season.

If boars do not breed when people are around, it may be because they are timid or shy. Isolated pens and breeding at night may be the solution.

If you plan to go into the two litter-per-year system, it is advisable to start with fall gilts. In this way, the fall litter comes early and the next spring litter can be adjusted to suit conditions (housing).

Gilts in good growing condition will start coming into heat when they are about five months of age.

While some sows will come into heat from 3-5 days after farrowing, it is not good practice to breed them at this time. A more reliable time is 3-5 days after weaning.

Breeding during the latter part of the heat period seems to result in larger litters, and sows appear to settle better under this practice.

In weaning the litter, remove the litter at night. After about five nights, sows will usually respond to mating.

The gestation period of sows will vary from 110-116 days.

Swine Thumb Rules (continued)

There should be a steady gain in weight for both gilts and sows from breeding to farrowing time. Gilts will approach farrowing carrying more flesh than sows. Regulated feeding should be followed to allow gilts to gain 100-125 lbs. during gestation. Sows, in good condition when bred, should gain 74-100 lbs.

Proper handling of the brood sow is important; about two thirds of the fatal pigs is made during the last four weeks of gestation.

Longevity in swine varies but, as long as there is no trouble, a sow can be kept for 2 to 10 litters.

FARROWING

Fifty square feet of floor space should be provided for the sow at farrowing time. Guard rails should be installed 8-10 inches from the walls and the same distance from the floor.

Farrowing house temperature should be maintained at about 57°F. At temperatures lower than 50°F, the young pigs become chilled. In such cases pig brooder with a 100 watt bulb may be used.

A good disinfectant to use in preparing the farrowing pen is one can (13oz) of lye in 10 gallons of hot water. Apply this to floor and walls with an old broom.

A sow will usually have a feverish condition for several (10-12) hours after she has farrowed. At this time, she should have ample water, but little if any feed. She should be brought back on feed gradually, regaining full feed at 7-10 days following farrowing. Large feedings of wheat bran or other laxative feeds are desirable in the days immediately after farrowing.

It is a good practice to weigh pigs within 24 hours after birth and record the weights. Ear notching may also be done at this time, as well as removing the naval cord two inches from the body and clipping needle teeth.

One-third of all pigs farrowed die weaning (before). The hog raisers lose one pig for every two raised. Saving these pigs would mean a 50% increase. Every pig born dead represents a loss of about two bushels of feed.

The heavier a pig is at birth, and at weaning time, the earlier it will reach market weight.

A pig's chances of living to weaning age are five times greater if he/she weighs 2½lbs. at birth rather than if

Swine Thumb Rules (continued)

he/she weighs $1\frac{1}{2}$ lbs. at birth.

Special care must be provided for pigs weighing less than two pounds at birth. They chill quickly and about 80% of them will die unless special attention is given.

Orphan pigs may be fed whole cow's milk that is sweet and warm. Feed at 3 hour intervals, 5-6 feedings per day. This can be done with a bottle and nipple or by teaching them to drink from a shallow pan. They should soon be taking a quart of milk in a 24 hour time. Give little, if any grain before they are 10 days old. Reduce milk feedings to 3 per day when pigs are 3 weeks old. Gradually taper off the milk at 6-8 weeks, increasing the grain.

The sows that milk the heaviest will eat the most and be the thinnest at weaning time. During that time, it is not uncommon for sows of this type to eat as much as 4 lbs. of grain for each 100 lbs. of body weight. Sows having litters of 2-3 pigs should be fed considerably less to avoid an over-fat condition at weaning time.

A week to 10 days after farrowing, (the pigs are then off to a good start and the sow is back on full feed) the sow and litter should be provided with good pasture. Good pasture can save up to 15% of the feed bill plus the sanitary advantages of clean pasture.

Selecting Swine

*Terms: All terms underlined are in the "Glossary of Terms."

I. Considerations for Swine Breeding Programs

Because of a decrease in the demand for lard and a demand by consumers for lean pork, producers have had to change from the over-fat, lard type hog to the lean, meat type hog which produces a maximum of quality pork with a minimum of waste and trim.

Considering the length of time pork producers have spent attempting to change the type of hogs, a person unfamiliar with the type being produced today would think that all hogs are of meat type; however, it is estimated that 75% of the hogs marketed are wasty and over-fat.

Swine producers can produce more muscular hogs with less fat by following a planned selection and breeding program. Such hogs are more valuable on today's market, and their lean, tender cuts find favor with the consumer.

This meat-type market hog can be produced by selecting gilts and boars that have good length (30-in. carcass on a 200-pound hog) with thick, muscular conformation and just enough fat to insure carcass firmness and to give quality and flavor to the cuts.

II. Selecting Individual Animals

As is true in all classes of livestock, selection of swine breeding stock is a constant process for the breeder. The four bases for selecting swine are type, production testing, pedigree, show-ring winnings, and health, vigor, and disposition.

A. Selection Based on Type and Conformation

There is a close relationship between the conformation of a meat-type hog and its production traits such as backfat thickness and litter size. The first essential to a profitable pork program is large litters of pigs raised to weaning age. These pigs must be fast-growing, able to convert grain and supplement into pounds of pork at an efficient rate, and possess other traits that are profitable for the producer.

There is some disagreement among swine breeders as to what is meant by meat type, but most agree that

Selecting Swine (continued)

a meat-type hog will have the following characteristics:

1. Yield 50% of live weight in primal cuts: Ham, Loin, Picnic, and Boston Butt
2. Weigh 200-210 pounds at 5½ months of age
3. Backfat thickness less than 1.5 inches
4. Loin eye four square inches or more
5. Feed conversion of one pound gain to 3.5 pounds or less of feed
6. Females produce and raise eight or more pigs per litter

Transparency No. 2

Selection based on type or conformation implies the selection of animals that most closely approach the ideal and the culling of those that fall short of these standards.

In order for the person(s) making the selection to properly describe the hog, he/she should learn the parts of a hog.

Transparency No. 3

Market hogs weighing from 180 to 200 pounds will yield about 45.5% of their live weight in the four primal cuts: shoulder, loin, bacon, and ham. Yet, because of the higher value per pound of these primal cuts, they represent approximately 75% of the retail value of the hog. For this reason, one should learn the four primal cuts of the pork carcass and the area from which these cuts are produced.

Of the four primal cuts mentioned, about 23% of the hog carcass is untrimmed shoulder, the loin is approximately 20%, the marketable bacon represents about 17%, and the ham represents from 22-28% of the weight of the carcass.

Transparency No. 4

The next essential step in selection or judging is to have the ideal animal clearly in mind.

The meat-type hog will have an even arch over a strong-muscled back, a trim jaw, trim underline, and a firm finish. He will have good width between the front and hind legs.

The most important criterion in determining whether a hog is truly meat-type is the amount of muscling as indicated by a high lean-to-fat ratio.

On the basis of U.S.D.A. Grades the expected yields of the four primary wholesale cuts based on chilled carcass weight are as follow:

Selecting Swine (continued)

<u>Grade</u>	<u>Yield</u>
U.S. No. 1	53% and over
U.S. No. 2	50% to 52.9%
U.S. No. 3	47% to 49.9%
U.S. No. 4	Less than 47%

In selecting or judging hogs on type and conformation, one would follow a system similar to that recommended for selecting other classes of livestock. The recommended order of observation is Step I, side view; Step II, rear view; Step III, front view; and Step IV, contact step. The animal should be observed from a distance of 20 feet in the first three steps. The fourth step may be used to inspect characteristics that cannot be inspected from a distance. This system should be followed each time in hog selection.

When selecting breeding stock, one should select animals with the same characteristics as a desirable market hog. In addition, the underline should be observed on all breeding stock before an animal is purchased. Teat placement and blind teats should be observed on gilts and sows, and the rudimentaries should be observed on boars. Both sexes should have a minimum of twelve evenly spaced, well developed teats. Animals selected for breeding stock should also stand on sound feet and legs.

B. Production Records as a Basis of Selection

The first program initiated to test swine in order to determine their productive ability was established by one of the major breed associations in 1938. A single set of rules was adopted by all the major breed associations for production testing in 1946; however, there are some differences in the characteristics tested and method of testing used by breed associations today.

No single selection plan fits all breeders and producers, but sound production information coupled with competent visual appraisal permits the most accurate selection of breeding animals.

Any profitable selection program must be based on the ability of an animal to perform. This opinion is reflected in the wider acceptance and use of Production Registry, breed Meat-Type Certification Programs, and "On-the-Farm" Performance Testing and Gilt Selection Programs.

Production Registry, one of the programs used to test the productive ability of swine, generally is concerned with testing the following characteristics:

Selecting Swine (continued)

a. Number of pigs farrowed

For an animal to be registered, it must be from a litter of eight or more pigs, and these pigs must be raised to 56 days of age.

b. Litter weight

To qualify for Production Registry, the litter farrowed from a gilt must weigh 275 pounds and a sow's litter 320 pounds at 56 days of age. This requirement will give a better indication of the sow's mothering ability.

c. Birth weight

This is another characteristic used by some breed associations for Production Registry.

For a sow to qualify for Production Registry, she must produce two litters that meet the requirements; the boar must sire several production registered daughters to qualify as a Production Registry sire.

After being admitted for Production Registry, the litter is ready to be tested as a Certified Litter. To be certified, the pigs in the litter must meet the following qualifications:

- a. Two pigs from the litter must weigh 200 pounds each at 170 days of age.
- b. These pigs must have 1.5 inches of backfat or less.
- c. The carcass of each pig must measure 29 inches from the first rib to the aitch bone.
- d. The loin muscle must be at least four square inches at the tenth rib.

The mating of a certified sow to a certified boar is known as certified mating, and the letters PR, CMS, and CL are included on the registration papers of swine qualifying for Production Registry, Certified Meat Sire, and Certified Litters.

The "On-the-Farm" selection program is based on litter records, rate of gain, and neatness as determined by backfat probing. It is one of the most highly effective programs for selecting more muscular, more profitable gilts.

Transparency No. 5

This "Sow Record Form" is a sample of the type of record used with the "On-the-Farm" selection program.

Selecting Swine (continued)

Transparency No. 6

Another performance factor to consider in selecting breeding hogs is the heritability of some of the economically important traits. Much improvement can be made in traits with high heritability (carcass traits) through individual selection of superior boars and gilts. Traits which are less than 30% heritable, such as litter size, respond little to individual selection. The traits which are low in heritability are improved most through management, such as crossbreeding, proper nutrition, and health.

Transparency No. 7

Summary of Performance and Carcass Data

C. Pedigree as a Basis of Selection

The pedigree, when used as a basis for selecting breeding swine, provides a record of the animal's ancestry. For animals that qualify for Production Registry, Certified Meat Sire, and Certified Litter, the pedigree indicates that the animals have qualified as designated by the letters PR, CMS, and CL on the registration certificate. A recognized pedigree which carries impressive production records lends confidence in projecting how well young animals will perform when selected as breeding stock. However, it is noted that mere names and registration numbers are meaningless unless the superior individuals and outstanding producers are close up in the lineage.

The breeding boar should always be purebred and of known ancestry. In addition, he should be a good representative of the breed selected. Breeding sows should be of good ancestry, whether they are purebreds, grades, or crossbreds. Again, if pedigree selection is to be of utmost value, one should be familiar with the individual animals which make up the pedigree.

D. Show-ring Winnings as a Basis of Selection

A principal value of selections based on show-ring winnings may be that shows direct the attention of the amateur to the type and bloodlines of hogs that are currently meeting the approval of the better breeders and judges. In most cases, the selection of breeding hogs on the basis of show-ring winnings has been for the good; however, attention should be given to the type of animals that are winning the

Selecting Swine (continued)

shows to determine whether such animals are efficient from the standpoint of a producer.

E. Health, Vigor, and Disposition as a Basis of Selection

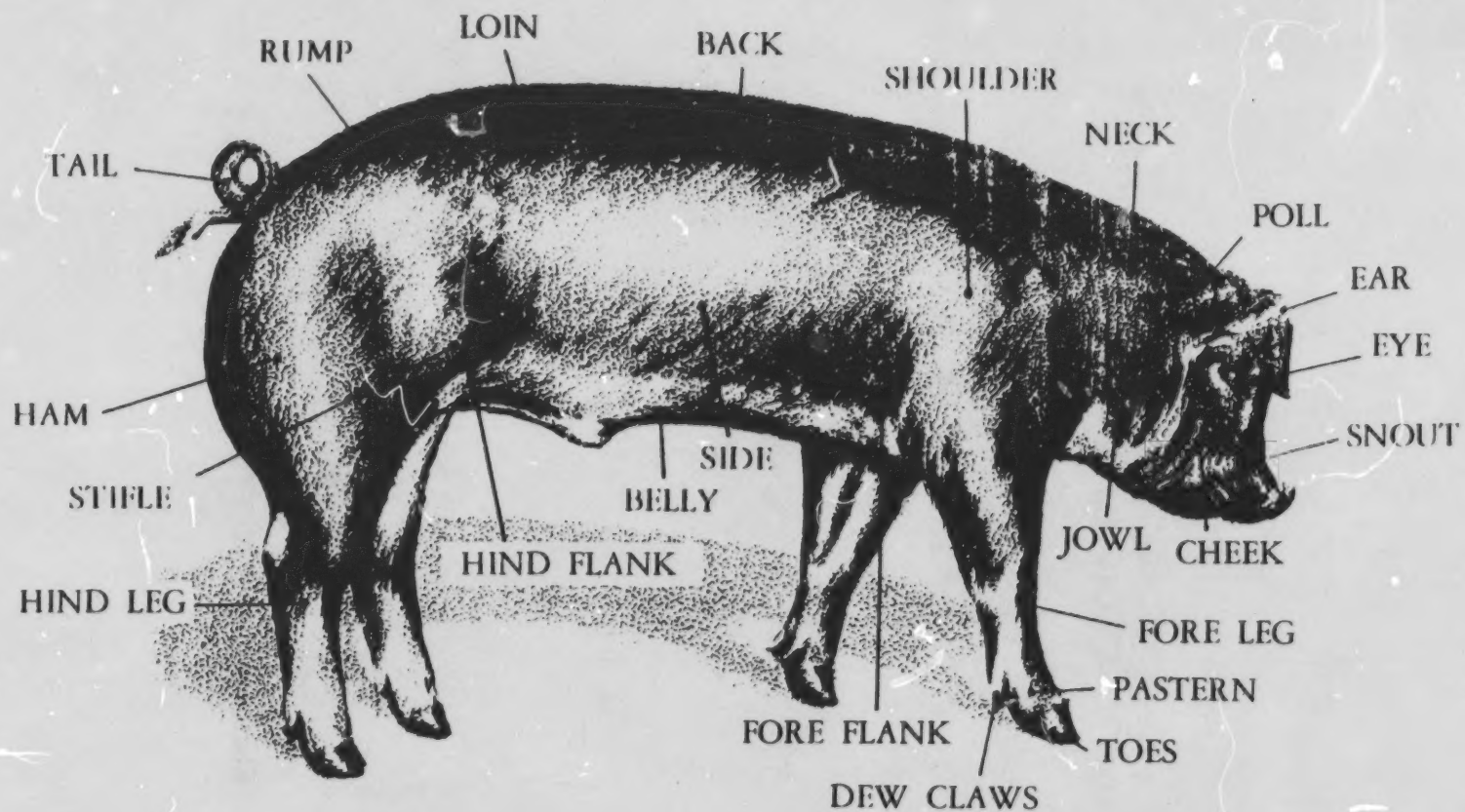
A good policy to use in selecting hogs-as in selecting all livestock-is to purchase individuals that are large for their age and in good health. The prospective producer should purchase breeding stock from a reputable breeder who maintains a good sanitation program and a disease-free herd. Another important consideration is to select animals that have been vaccinated for all the diseases common to the area prior to purchase.

Since the disposition of the sow will affect the number of pigs saved at farrowing time, the producer should select animals that have a quiet disposition. Quiet, gentle animals generally have such a disposition.

CHARACTERISTICS OF MEAT TYPE HOGS

1. YIELD 50% OF LIVE WEIGHT IN PRIMAL CUTS: HAM, LOIN, PICNIC, AND BOSTON BUTT
2. WEIGH 200 TO 210 POUNDS AT 5½ MONTHS OF AGE
3. BACKFAT THICKNESS LESS THAN 1.5 INCHES
4. LOIN EYE 4 SQ. INCHES OR MORE
5. FEED CONVERSION OF 1 POUND GAIN TO 3.5 POUNDS OR LESS OF FEED
6. FEMALES PRODUCE AND RAISE 8 OR MORE PIGS PER LITTER

PARTS OF A HOG



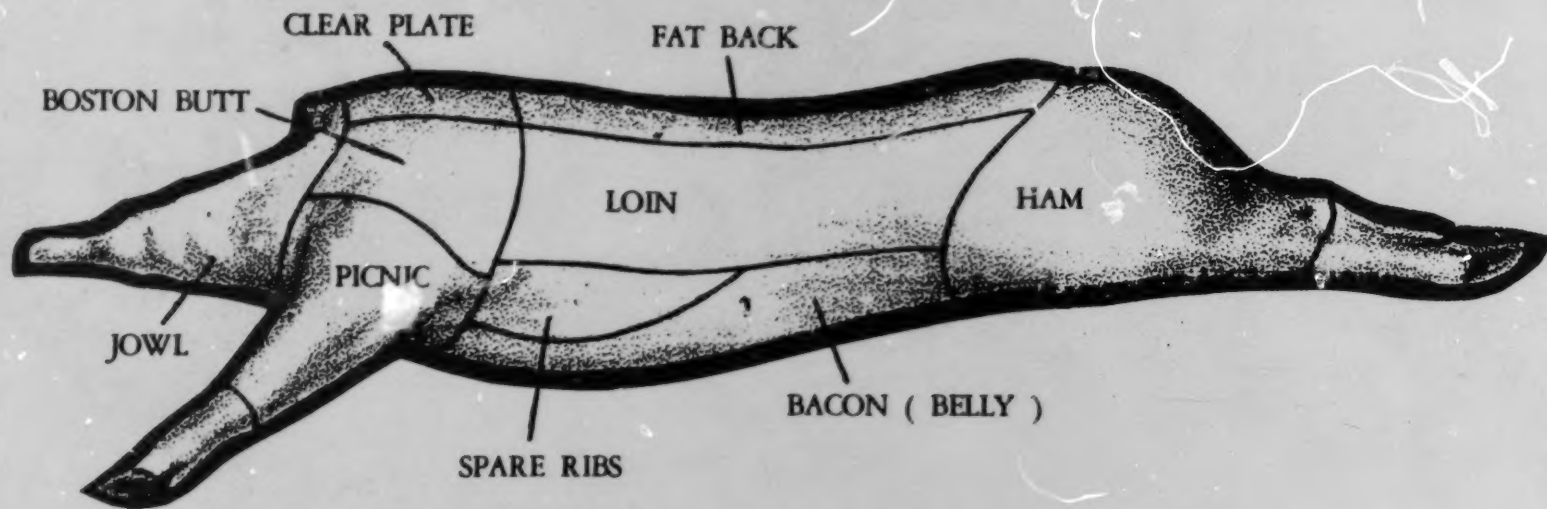
TM-2

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672

673

WHOLESALE CUTS OF PORK

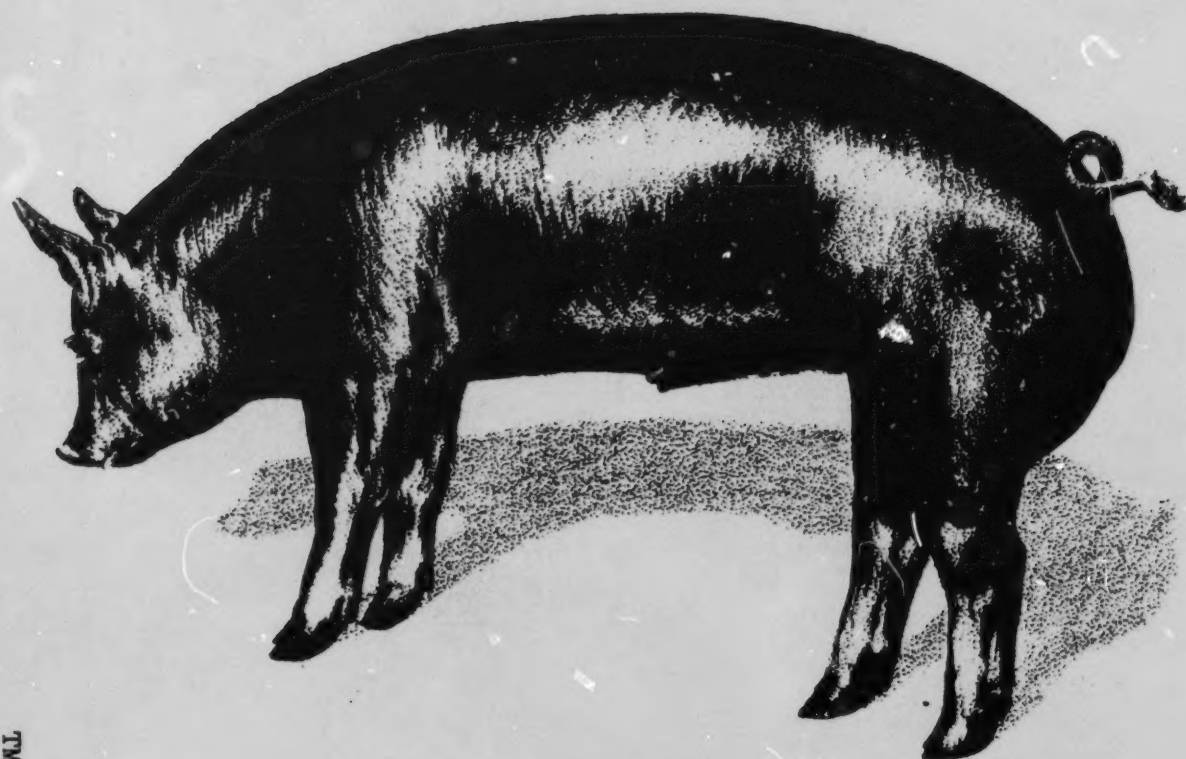


SHEEP PRODUCTION RECORD FORMS

TM-3

AG-XV-37

IDEAL SWINE CONFORMATION



SIDE VIEW



REAR VIEW

TM-4

AE-VV-38

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SOW RECORD

SOW NO. _____

SOW'S _____ LITTER

(1, 2, etc.)

BIRTH DATE OF SOW _____

180-DAY WT. _____ 200 LB. PROBE _____ FEED/100 LB.
GAIN _____



EAR NOTCH

FARROWING DATE _____

TOTAL FARROWED..... MALE _____ FEMALE _____

FARROWED ALIVE..... MALE _____ FEMALE _____

TOTAL WEANED..... MALE _____ FEMALE _____

_____ DAY LITTER WT. _____
21, 35, 56, etc.

NAME _____ REG. NO. _____ BOAR NO. _____

BREED _____ BREED _____

EAR NOTCH		PIG NO.	SEX	BIRTH WEANING		AGE WEIGHED _____ DAYS		BACKFAT PROBE					REMARKS
R	L			WEIGHT (OPTIONAL)	WEIGHT	ACTUAL WT.	ADJ. 15-DAY WT.	SHLDR. IN.	BACK IN.	LOIN IN.	AV. IN.	ADJ. TO 200 LB.	

AV. 154-DAY WT. OF LITTER _____ FEED PER 100 POUNDS GAIN _____



SWINE HERITABILITY ESTIMATES

TRAITS	APPROXIMATE HERITABILITY (PERCENTAGE)
--------	--

Productive traits:

LITTER SIZE AT BIRTH	5-15	} LOW
LITTER SIZE AT WEANING	5-15	
LITTER WEANING WEIGHT	10-20	

Feedlot traits:

POST WEANING GAIN	25-35	} MEDIUM
FEED PER UNIT GAIN	30-40	

Carcass traits:

LENGTH	50-60	} HIGH
BACKFAT THICKNESS	45-55	
LOIN EYE AREA	45-55	
YIELD OF LEAN CUTS	35-45	

SUMMARY OF PERFORMANCE AND CARCASS DATA OF 169 PIGS

LITTER TESTING PROGRAM

	ADG	FEED EFFICIENCY	DRESS %	CARCASS DATA						
				LENGTH	BACKFAT	LOIN-EYE AREA	% LEAN CUTS			VALUE / CWT (LIVE)
							CARC.	SL. WT.	QUALITY SCORE	
AVERAGE OF 169 HOGS	1.57	332	72.3	30.1	1.31	4.72	57.3	41.5	4.36	24.64
RANGE										
MOST DESIRABLE	2.14	278	75.5	33.1	.68	6.62	67.0	47.3	8.00	26.91
LEAST DESIRABLE	1.16	439	67.3	28.1	1.83	3.49	48.8	35.5	1.00	22.53
10 HIGHEST VALUED, AV	1.68	316	73.6	30.2	1.24	5.15	59.0	43.4	5.12	25.83
10 LOWEST VALUED, AV	1.74	330	71.2	30.1	1.44	4.13	53.4	37.9	4.12	23.06

TM-7

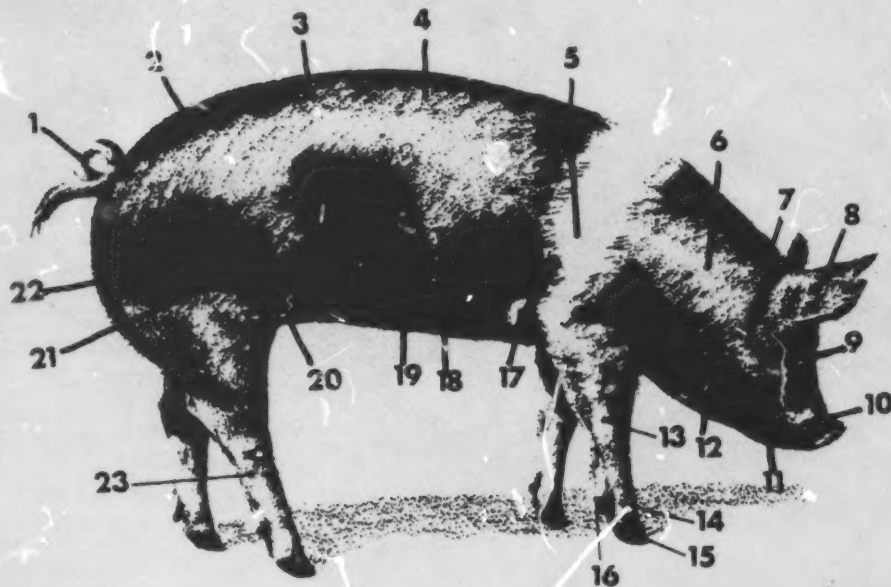
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SELECTED STUDENT ACTIVITIES

1. What are some factors that one should consider when selecting breeding swine for a production enterprise?
 - a.
 - b.
 - c.
 - d.
 - e.
2. In your own words, describe the conformation and give some characteristics of an ideal meat-type hog.

SELECTED STUDENT ACTIVITIES (Continued)

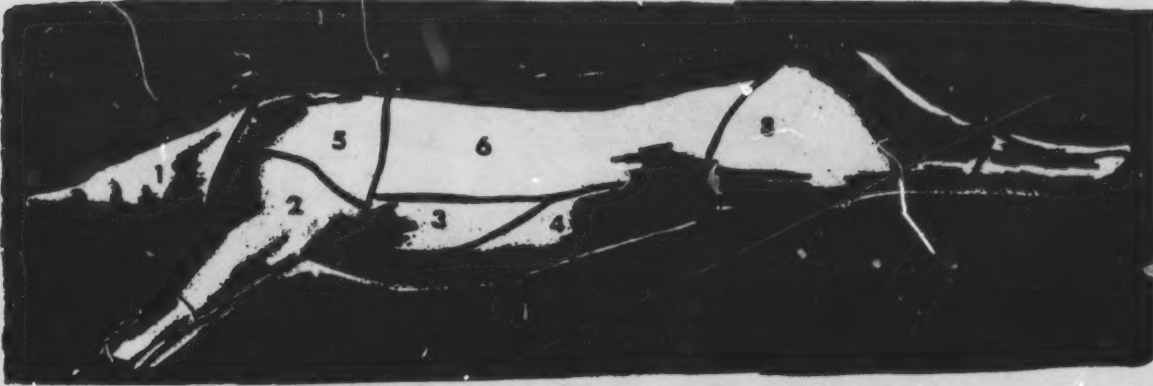
3. List the parts of a hog as identified on the illustration below.



- | | |
|-----|-----|
| 1. | 12. |
| 2. | 13. |
| 3. | 14. |
| 4. | 15. |
| 5. | 16. |
| 6. | 17. |
| 7. | 18. |
| 8. | 19. |
| 9. | 20. |
| 10. | 21. |
| 11. | 22. |

SELECTED STUDENT ACTIVITIES (Continued)

4. List the wholesale cuts of pork as they are identified on the illustration below:



- | | |
|----|----|
| 1. | 5. |
| 2. | 6. |
| 3. | 7. |
| 4. | 8. |

5. What are the four primal cuts from the pork carcass that represent about 75% of its retail value? About what percent of the carcass does each primal cut represent?

PRIMAL CUTSPERCENT

a.

b.

c.

d.

6. What are some of the characteristics and standards that must be met to qualify for Production Registry?

a.

b.

c.

SELECTED STUDENT ACTIVITIES (Continued)

7. In order for a litter of pigs to satisfy the requirements of a Certified Litter, what are the qualifications that must be met?
 - a.
 - b.
 - c.
 - d.
8. List the economically important traits that have a high heritability chance (35% and above) for improving performance and production through individual selection.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
9. How much emphasis should be placed on pedigree when selecting a breeding boar?
10. Of what value may show-ring winnings be when used as a basis for selecting breeding swine?
11. In what ways should one consider the health and disposition of hogs when selecting breeding stock?

AGRICULTURAL MECHANICS

Instructor's Guide

1. This unit was designed as a basic introduction to Agricultural Mechanics. There are three blocks of time, each intended to be two weeks in length for a total of six instructional weeks in the entire unit.
2. The three blocks are as follows:
 - Welding - 2 weeks - Arc 1 week
OA 1 week
 - Wood Project - 2 weeks
 - Tool Fitting - 2 weeks - Tool Repair 1 week
Tool Fitting 1 week

The above division allows a class to be split into three groups and rotation of the groups at two-week intervals.
3. Before any student is allowed in the shop they must:
 - a. Pass a safety test on tools and equipment used during the unit with 100 percent accuracy. (Sample shop safety tests are available from Hobart and Illinois - References noted).
 - b. Secure and be prepared to use industrial quality eye protection.
 - c. Secure and be prepared to use appropriate shop protective clothing (coveralls, usually local cleaners sell used coveralls very inexpensively).
4. Tool identification should be accomplished by opening your tool cabinets and labeling the tools. Leave them in place and have the students learn both the tool and the correct location of the tool in the shop. Test tool identification and use knowledge.
5. Complete basic shop plans reading exercise by distributing the plans for the projects students will make during the coming weeks. Go over these plans with the students so they understand them completely.
6. Grade students on project quality, safety and clean-up. (Consider a daily grade on work accomplished, safety and clean-up in addition to a project grade.)

7. All demonstrations and safety test must be given before the students enter the shop for project work.
8. Materials included with this unit include:
 - a. Steps in keeping a clean, orderly shop
 - b. Safety color code and shop safety
 - c. Fire safety
 - d. Common Tools
 - e. Reading Plans
 - f. Sample safety pledge and parent approval form (optional - instructor's discretion)
 - g. Arc Welding
 - h. Oxygen - Acetylene Welding
 - i. Basic Woodworking (hand and power tools)
 - j. Fasteners
 - k. Rope work
 - l. Soldering
 - m. Computation of Bills of Materials
 - n. Measuring and Marking Devices
 - o. Bolting, Riveting, and Removing Broken Bolts
 - p. Cutting Cold Metal
 - q. Filing Cold Metal
 - r. Bending and Shaping Metal
 - s. Tool Fitting
 - t. Project Plans

Student Activities

1. Participate in skills and safety demonstrations and pass the safety tests with 100% accuracy.
2. Learn the names, use and location of tools in the agricultural shop.
3. Read and understand plans for skill development projects to be constructed during the upcoming weeks.
4. Complete assigned arc welds.
5. Complete oxygen - acetylene assignment.
6. Complete wood project.
7. Complete tool reconditioning.
8. Complete tool fitting exercise.

References

1. Wakeman, T.J., Modern Agricultural Mechanics, 1977, Interstate.
2. Hobar Publications: Power Tool Safety and Operation, 1234 Tiller Lane, St. Paul, MN 55112 -- approximate cost \$11.00.
3. Oregon Agriculture I Guide Materials, 1981.
4. Students Manuals, Texas A&M University on Agricultural Mechanics. Vocational Industrial Services
Texas A&M University
F.E. Box 182
College Station, Tx 77843
5. Illinois instructional materials - sample shop safety tests. Vocational Agricultural Service
College of Agriculture
University of Illinois
434 Mumford Hall
Urbana, Il. 61801

SPECIFIC OBJECTIVES

Upon completion of this unit, the student should be able to:

1. Discuss in a short paragraph the importance of using eye protection in the shop.
2. List steps to be taken involving accidents and first aid.
3. Identify 30 common tools used in the agriculture mechanics shops.
4. Understand safe work habits by passing the safety tests with 100 percent accuracy.
5. Understand basic shop plan reading.
6. Complete assigned arc welds.
7. Complete assigned oxygen - acetylene welds.
8. Complete assigned wood project.
9. Recondition hand tools.
10. Fit hand tools.

Suggested ActivitiesInstructor Activities

1. Provide students with objective sheet at your discretion.
2. Make transparencies.
3. Discuss terminal and specific objectives.

4. Discuss information sheets and handouts.
5. Give demonstrations.
6. Give tests.

Student Activities

1. Read objective sheet.
2. Study teaching outline and take notes.
3. Complete the safety tests.
4. Take tests.
5. Complete assigned projects.

STEPS IN KEEPING A CLEAN, ORDERLY SHOP

- a. Store equipment being repaired or constructed in an orderly fashion at the end of the work period.
- b. Clean and store tools, helmets, and goggles in their proper place at the end of the work period.
- c. Report broken tools or equipment to the teacher immediately.
- d. Place oily rags in covered cans.
- e. Turn off all arc welders when job is done.
- f. Shut off oxyacetylene welding outfits at cylinders, drain hoses, close oxygen and acetylene blow pipe valves, clean welding tables, and restore rods to the holders at the close of the work period.
- g. Be responsible for the area or station assigned to you.
- h. Brush all benches, tables, and the floor at end of work period.
- i. Keep tools in their proper places.
- j. Do not scuffle or join in horseplay in the shop.
- k. Do not run in the shop.
- l. Do not work with tools or equipment with which you have not received instruction.
- m. Make sure that all electrical equipment is turned off at end of day.
- n. Use tools for their specific purpose.
- o. Supply all visitors with face shields upon entering the shop.
- p. Store personal property including project property in designated locations.
- q. Do not waste time.
(NOTE: Conduct in the shop should be the same as that of regular class time. Suggestion: Set up an employer-employee system within which the student gets paid - points - for work accomplished)
- r. Check all clothes before returning them to lockers after class time.
- s. Clean shop coveralls regularly.

PURPOSES OF THE SAFETY COLOR CODE

- a. Reduces glare by diffusing sufficient light for better vision throughout the shop.
- b. Reduces eyestrain, tension, and fatigue by "setting off" material from machines and work areas.
- c. Promotes safety by pointing out critical parts and areas.
- d. Promotes better housekeeping by providing a more pleasing environment.

(NOTE: Colors used in the safety code as applied to the shop are given below)

Green - Applied to non-critical parts of equipment and machined surfaces, nameplates, and bearing surfaces; used to designate the location of safety and first aid equipment.

Yellow - Applied to operating levels, wheels, handles and hazardous areas which may cause stumbling, falling, or tripping; used to designate caution.

Orange - Applied to electrical switches, interior surfaces of doors on fuse and electrical power boxes, movable guards and parts, inside of non-movable guards, traffic lanes and overhead hazards; used to designate dangerous parts of equipment which may cut, crush, shock or otherwise injure.

Red - (Physical color associated with fire) Used to identify the location of fire-fighting equipment.

(NOTE: Emergency fire exits shall be designated in red. Buttons or levers for electrical switches used for the stopping of machinery should be designated in red. Gasoline cans should be painted red with the additional identification in the form of a yellow band around the can.)

Blue - Used as the basic color for designating caution against starting equipment while it is being worked on or against the use of defective equipment.

(NOTE: A blue tag should be attached to defective equipment. The tag should be lettered "Out of Order.")

Ivory - Can be applied to table edges, vise jaws, and edges of tool rests to reflect light and "show the way."

Aluminum - (Also unpainted steel) Can be applied to tops of tables and work areas to provide contrast with work.

INDUSTRIAL QUALITY EYE PROTECTION

- a. EYE PROTECTIVE DEVICES ARE REQUIRED TO BE WORN ANY TIME YOU ARE IN THE SHOP.
- b. Protects student and teacher participating in or observing instruction.
- c. Cautions against harmful conditions.
 - (1) Hot molten metals or other molten materials.
 - (2) Milling, sawing, turning, shaping, cutting, grinding, or stamping of any solid materials.
 - (3) Heat treatment, tempering, or kiln firing of any metal or other materials.
 - (4) Gas or electric arc welding or other forms of welding processes.
 - (5) Repair or servicing of any vehicle, motor, machinery or equipment.
 - (6) Caustic or explosive materials.

STEPS TO BE TAKEN INVOLVING ACCIDENTS AND FIRST AID

- a. Report all accidents to the teacher immediately.
(NOTE: If a serious injury is apparent, the hospital or school nurse should be contacted immediately. Do not attempt to move the victim until help arrives.)
- b. Use basic first aid:
 - (1) Stop the bleeding.
 - (2) Clear the airway.
 - (3) Treat for shock.
- c. Familiarize yourself with school policy for accident situations.

FIRE SAFETY

1. Components of the fire triangle (Transparency 1).
 - a. Fuel - Any combustible material.
 - b. Oxygen - Necessary to sustain combustion.
 - c. Heat - Enough to raise the fuel to its ignition temperature.

(NOTE: To produce fire these three elements are necessary and must be present at the same time. If any one of the three is missing, a fire cannot be started or with the removal of any one of them, the fire will be extinguished.)

2. Classes of fire.
 - a. Class A - Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish.
 - b. Class B - Fires that occur with flammable liquids, such as gasoline, oil, grease, paints and thinners.
 - c. Class C - Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring.
 - d. Class D - Fires that occur with combustible metals, such as magnesium.

3. Types of Fire Extinguishers (Transparency 2)
 - a. Pressurized water - Operates usually by squeezing a handle or trigger; used on Class A fires.
 - b. Soda acid - Operates by turning extinguisher upside down; used on Class A fires.
 - c. Carbon dioxide (CO₂) - Operates usually by squeezing a handle or trigger; used on Class B and C fires.
 - d. Dry chemical - Operates usually by squeezing a handle, a trigger or lever; used on Class B, C, and D fires.

(NOTE: On Class D fires, dry sand is as effective as any dry chemical other than Purple X. The cost of Purple X chemical places it out of reach of most shops.)

- e. Foam - Operates by turning extinguisher upside down; used on Class A and B fires.
 - f. Suggestions - Have the fire department of your community come and give fire demonstrations using various extinguishers.

Types of Fire Extinguishers



**Pressurized
Water**



Soda-Acid



**Carbon
Dioxide**



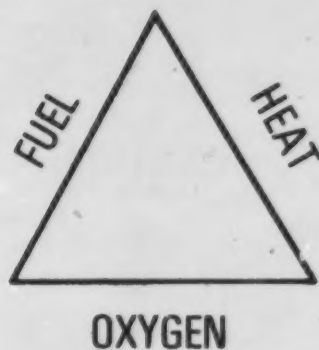
**Dry
Chemical**



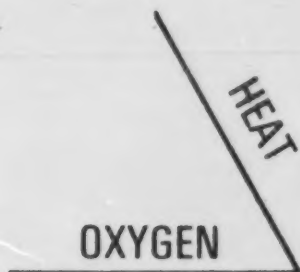
Foam

The Fire Triangle

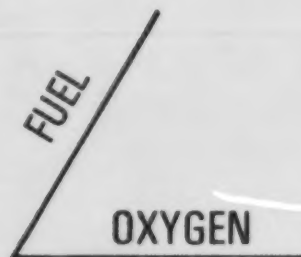
To produce fire, three things must be present at the same time.



If any one of the three is missing, a fire cannot be started or, with the removal of any one, the fire will be extinguished.



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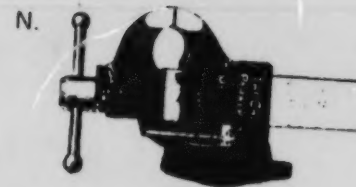
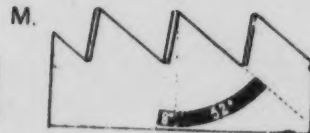
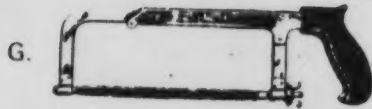
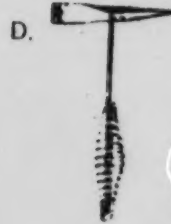
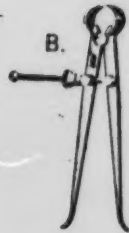


Common ToolsA. Common tools used in agricultural mechanics shops
(Transparencies 3, 4, and 5)

- a. Dividers
- b. Inside calipers
- c. Outside calipers
- d. Welder's chipping hammer
- e. Burr reamer (pipe reamer)
- f. Hand drill
- g. Adjustable hacksaw
- h. Jack plane
- i. Carpenter's brace
- j. Ripsaw
- k. Wire brush
- l. Crosscut saw teeth
- m. Ripsaw teeth
- n. Machinist's vise
- o. Adjustable end wrench
- p. Slip-joint pliers
- q. Bolt cutter
- r. Combination wrench
- s. Ball-peen hammer
- t. Soldering copper
- u. Open-end wrench
- v. Standard screwdriver
- w. Carpenter's level
- x. Wood chisel
- y. Steel-framing square
- z. Vice-grip pliers
- aa. Wrecking bar
- bb. Pipe wrench
- cc. Tinner's snips
- dd. Combination square
- ee. Pipe cutter
- ff. Steel tape
- gg. Tap wrench
- hh. Allen wrench
- ii. Diestock
- jj. Curved claw hammer
- kk. Flat file
- ll. C-clamp
- mm. Folding rule
- nn. Round file
- oo. Phillips screwdriver

Suggestion: Label tools in cabinets, allow students to learn tools and its proper location simultaneously, test on tool knowledge by bringing the actual tool in the classroom. Do not use the transparencies provided unless the preferred method is unavailable.

Common Tools



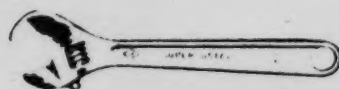
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Common Tools (Continued)

O.



P.



Q.



R.



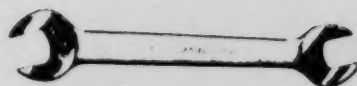
S.



T.



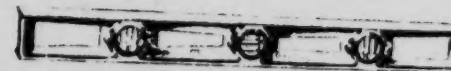
U.



V.



W.



X.



Y.



Z.



BB.



AA.



CC.



DD.

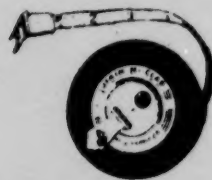


Common Tools (Continued)

EE.



FF.



GG.



HH.



II.



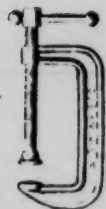
JJ.



KK.



LL.



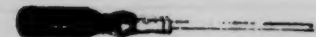
MM.



NN.



OO.



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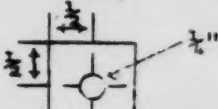
Reading Plans

- a. Distribute plans to be used during skill exercises.
- b. Discuss dimension notation.

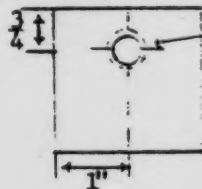
(1) $\begin{array}{c} + \\ | \\ + \end{array} \quad 3/8''$ outside dimension

(2) $\begin{array}{c} \text{---} \\ | \\ \text{---} \end{array} \quad 3/8''$ inside dimension

(3) $120^\circ /$ angle

(4)  size of hole and location for hole

(5) - - - - - hidden line

(6)  5/16" DR 3/8" NC size and location of hole plus tape and thread information

STUDENT SAFETY PLEDGE

1. I pledge myself to follow all rules and regulations pertaining to the safety of myself and others.
2. I will constantly watch for any unsafe acts, practices or conditions that might reduce the safety of myself or others.
3. I will report all unsafe acts, practices, or conditions to my teacher immediately.
4. I will do my job in a safe and orderly manner, so that I will not endanger the safety of myself or others.
5. I will report all injuries, no matter how slight, to the first aid department immediately.
6. I will keep my work place in a safe and orderly condition at all times.
7. I will promote and respectfully solicit the cooperation of all pupils in safety and good housekeeping.
8. I will bear in mind at all times that my job will be safe only as long as I make it safe.
9. I will never lose sight of the fact that accidents do not just happen, they are caused.
10. I will do these things with respect and mutual understanding in all my relations with my fellow pupils, because only in this way can I feel sure that I am doing everything within my power to make my room and my school a safer and better place in which to work.

SAFETY PRACTICE FORM_____
HIGH SCHOOL

_____, who is enrolled in a vocational
_____ course will, as a part of his/
her experience, operate machines, providing that his/
her parent or guardian gives written permission.

It is understood that each student will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it himself/herself.

The student must assume responsibility for the following safe practices, and we therefore ask that he/she subscribe to the following safety pledge:

1. I promise to follow all safety rules for the shop.
2. I promise never to use a machine without first having permission from the teacher.
3. I will not ask permission to use a particular machine unless I have been instructed in its' use and have made 100% on the safety test given on that machine.
4. I will report any accident or injury to the teacher immediately.

Date _____ Student's Signature _____

I hereby give my consent to allow my son/daughter to operate all machines and equipment necessary in carrying out the requirements of the course in which he/she is enrolled.

Date _____ Parent's Signature _____

Parents are cordially invited to visit the shops to inspect the machines and to see them in operation at any time.

Name _____

GENERAL SHOP SAFETY TEST

Answer the following by circling "T" if true and "F" if false.

- T F 1. You should always learn the right way to do a job.
- T F 2. Always work at a fast speed.
- T F 3. Report all injuries to instructor.
- T F 4. Observe all warning signs and tags.
- T F 5. Unless you have been taught to operate a machine, stay away from it.
- T F 6. Never attempt to make an adjustment or clear a jam while a machine is running.
- T F 7. Guards may be left off some machines.
- T F 8. It is permissible to leave a machine running while not in use.
- T F 9. Remove chuck wrenches from chucks immediately after wrench is used.
- T F 10. Use only tools and equipment in good condition.
- T F 11. Equip files with handles before using them.
- T F 12. Always use the proper tool for the job.
- T F 13. In lifting an object, be sure you have a good footing, then jerk the object.
- T F 14. Wear goggles when there is a chance of getting foreign material in your eye.
- T F 15. When working on or near machinery, don't wear worn or ragged clothing.
- T F 16. Before using a hammer, check the trademark.
- T F 17. When chiseling metal, wear goggles and caution nearby students against sparks.
- T F 18. To avoid flying metal chips, never use a chisel with a mushroom head.
- T F 19. When using a cold chisel on an empty barrel, the barrel should be filled with air.
- T F 20. Always put out the torch when it becomes necessary to readjust the work.
- T F 21. Always handle hot metal with gloves.
- T F 22. Open air valves quickly.
- T F 23. Never use oxygen as a substitute for compressed air.
- T F 24. First aid stations are marked with a red cross.
- T F 25. "Horseplay" should never occur in the shop.
- T F 26. Always have good ventilation when working.

ANSWERS TO ASSIGNMENT SHEET #2

1. T

2. F

3. T

4. T

5. T

6. T

7. F

8. F

9. T

10. T

11. T

12. T

13. F

14. T

15. T

16. F

17. F

18. T

19. F

20. T

21. F

22. F

23. T

24. F

25. T

26. T

ARC WELDINGOBJECTIVES

Upon completion of this unit, the student will be able to:

1. Match terms associated with arc welding to the correct definition.
2. List five safety precautions used in arc welding.
3. List two types of electrodes.
4. Select from a list the two most common sizes of electrodes used in agricultural mechanics.
5. Identify the meaning of the numbers in the electrode classification system.
6. List three purposes of electrode coating.
7. Describe the effect of raising and lowering the arc welding current.
8. Name two methods of establishing an arc.
9. Identify the characteristics of proper arc length.
10. Label the parts of a drawing associated with the welding process.
11. Identify three kinds of welds.
12. Identify five types of weld joints.
13. List four welding positions.
14. List four reasons for poor welds.
15. Demonstrate the ability to:
 - a. Start, stop and restart a bead.
 - b. Run beads with both E6011 and E6013 rod on a pad.
 - c. Construct a butt weld.

Instructor Activities

(It is left to the instructor's discretion as to the length of this unit - 1 or 2 weeks)

- a. Provide students with object sheet at your discretion.
- b. Make transparencies.
- c. Discuss terminal and specific objectives.
- d. Discuss teaching outline.
- e. Demonstrate and discuss procedures outlined in job sheets.
- f. Give test - optional.

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****NOTE:** (If the unit is planned for one week do start, stop and restart, and butt weld only; if the unit is planned for two weeks include T-fillet, Arc cut, and Tropy)

Instructional Materials

1. Included in this unit:

- a. Objectives
- b. Teaching outline
- c. Transparency masters
 - (1) TM 1 - AWS Classification of Electrodes
 - (2) TM 2 - Welding Process
 - (3) TM 3 - Kinds of Welds
 - (4) TM 4 - Types of Weld Joints
 - (5) TM 5 - Welding Positions
- d. Job sheets
 - (1) Job sheet #1 - Start, Stop and Restart a Bead
 - (2) Job Sheet #2 - Construct a Pad Weld
 - (3) Job Sheet #3 - Construct a Butt Weld
 - (4) Job Sheet #4 - Construct a T-Fillet Weld
 - (5) Cutting with Arc (E6011)
 - (6) Welding Trophy
- e. For safety tests and answers refer to Hobar publication, "Power Tool Safety and Operation"
Hobar Publications
1234 Tiller Lane
St. Paul, MN 55112
Phone (612) 633-3170
Cost: \$9.00

Teaching Outline:

ARC WELDING - INTRODUCTION & FUNDAMENTALS1. General Information

- a. Arc welding dates back to the latter part of the nineteenth century. The arc, struck between the electrode and the metal, heats the metal to about 11,000°F, then the electrode is removed to break the arc and allow the metal to solidify. This arc of intense heat is generated as the electric current passes through a highly resistant air gap. The air gap is the space between the lower tip of the electrode and the base metal (referred to as arc length).
- b. Arc welding may be defined as the process of fusing two or more pieces of metal together by using the heat produced from an electric arc welding machine. Another way the term may be used -- metals are fused together by an electric arc generated between an electrode and base metals.

- (1) Demonstration: Melt two ice cubes together with a match. When the match is removed the ice solidifies and freezes.

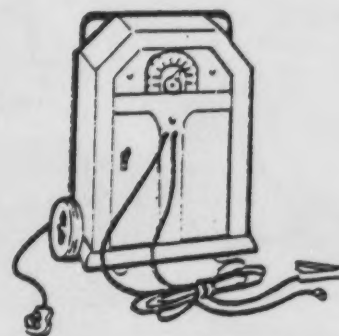


- c. Shielded metal - arc welding is another term used to identify the arc welding process. The coated electrode produces a gas which shields the arc from the atmosphere as the electrode melts. Similarly both the Tig (tungsten inert gas - arc welding) and the Mig (metal inert gas - arc welding) use a gas that protects the welding area from the atmosphere, however in the case of Tig and Mig the gas is supplied from a cylinder not generated by burning the electrode flux (for Tig and Mig the three most common gases are argon, helium and carbon dioxide.)
- d. Use of an Arc Welder:
 - (1) Scrap metal can be used to make a repair many useful items for hom and farm use.

- (2) Repairs can be made rapidly on farm machinery and equipment, which is good insurance during harvest time and many other critical periods.
- (3) Major cracks or breaks can be repaired on machinery and equipment before they cause a major repair problem.
- (4) Metal repair and construction jobs may be accomplished more economically with an arc welder than with other types of metal repair and construction equipment.
- (5) An arc welder can be used for jobs that require cutting, piercing, gouging, and beveling metal.

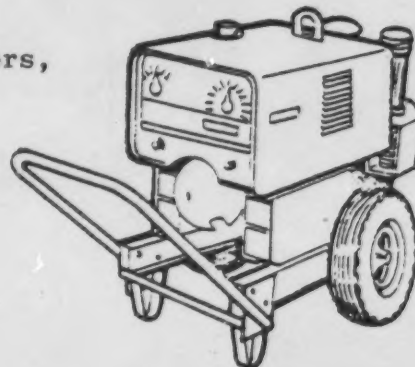
2. Types of Arc Welding Machines

- a. An AC (alternating current) welder is the most common type for general agriculture use. Alternating current reverses or alternates its direction of flow (polarity) at the rate of 60 times per second. The AC welder is usually a 180-ampere or 225-ampere unit and performs best where the power supply is between 220 and 240 volts.



- (1) Advantages of using 180-240 amp AC welders are:
 - (a) They can handle most agricultural jobs.
 - (b) The initial and maintenance costs are relatively low.
 - (c) A 180 amp AC welder has a "limited input" of no more than 37.5 amperes on a 230 volt single-phase circuit.
 - (d) The 225 amp welder, being somewhat larger, can handle electrodes one size larger than the 180 amp machine.

- b. DC (direct current) welders are generator-type welding machines that are powered by electric motors, gasoline engines, or other power sources. Direct current flows steadily and constantly in one direction.

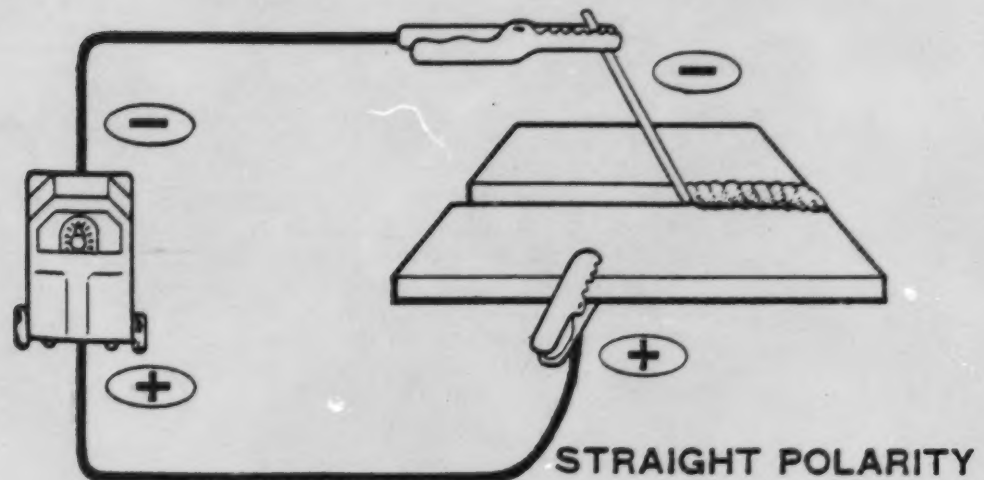


- (1) Advantages of using DC welders are:
 - (a) Portable models, powered by engines, can be mounted on trucks or trailers and taken to the work.

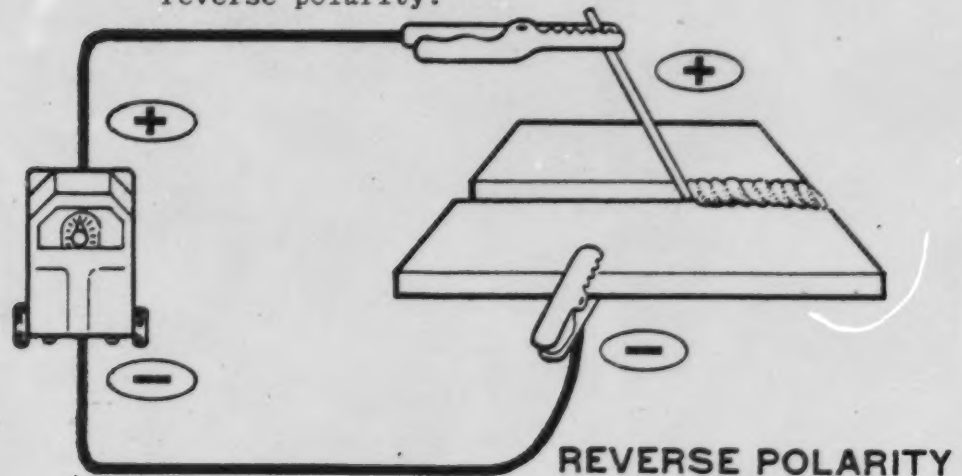
(b) Electric power is not necessary for a gasoline powered welder; therefore, they can be used as mobile units for repair work on construction.

(2) DC welders produce direct current of both straight (negative) and reverse (positive) polarity. Polarity is the direction in which the current flows across the arc.

(a) Straight polarity is when the electrode is negative and the work is positive.



(b) When the electrode is positive and the work is negative, the adjustment is reverse polarity.

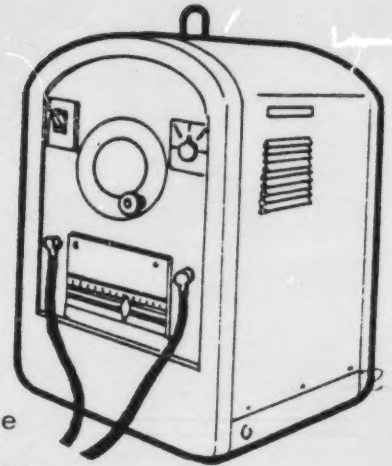


(c) Cast iron, thin metal, aluminum and bronze are welded with a reverse polarity adjustment. Mild steel is welded with a straight polarity adjustment.

- c. AD/DC welders are essentially welders equipped with a rectifier (an electronic device to convert AC to DC). If the rectifier is not operating, the welder is an AC type.

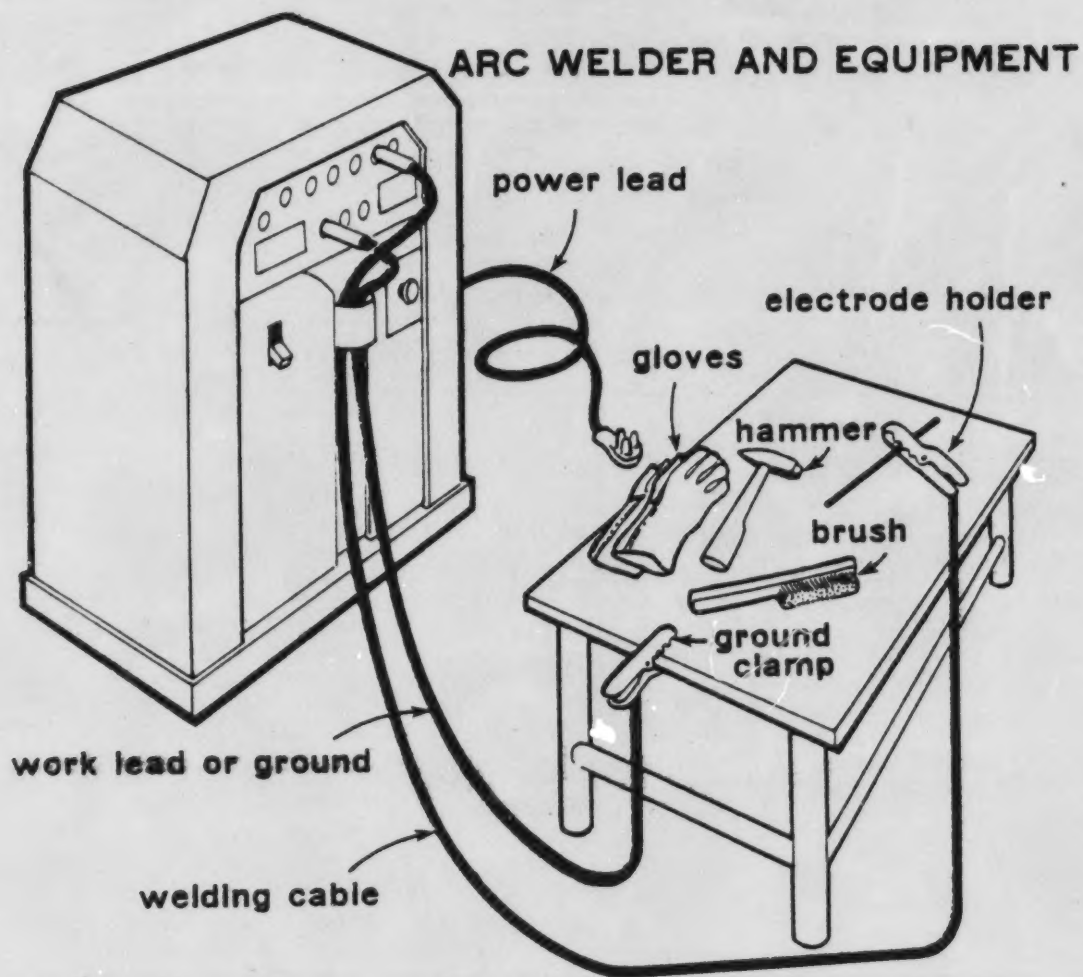
(1) Advantages of the AC/DC machine are:

- (a) With the rectifier operating, direct current is produced.
- (b) This unit is less expensive than the DC machine.
- (c) This unit is quieter operating than the DC machine.



3. Selecting a Welder and Other Equipment

- a. Select a welder that is made by a reliable manufacturer and sold by a reliable dealer.
- b. The dealer should be able to give prompt service when needed. The dealer should have an adequate supply of protective equipment, electrodes, and operational information.
- c. Check the guarantee on different machines as well as price when comparing welders of equal capacity.
- d. Be sure 230-240 volt service is available for optimum performance. Check the duty cycle of the welder and determine if it meets the needs of the work to be done. Duty cycle is the ratio of arc time to total time (example: 20% duty cycle would be 2 minutes of continuous use at maximum amperage output out of 10 minutes' clock time).
- e. The arc welder is usually equipped with ground and electrode cables. The cables are fitted with a ground clamp and an electrode holder.
- f. Additional welding equipment is as follows:
 - (1) Welding helmet with proper cover glass and filter lens
 - (2) Blacksmith tongs and pliers
 - (3) Gauntlet type leather gloves
 - (4) Chipping hammer and wire brush
 - (5) Welding table and stool
 - (6) C-clamps, industrial quality eye protection, water can, and scapstone
 - (7) Welding booth or portable screen.
 - (8) Power grinder
 - (9) Anvil and ball peen hammer
- g. Be sure that equipment is properly installed and maintained.



4. Safety Practices to Observe when using the Arc Welder

a. Electrical Shock

- (1) Be sure the welder is properly grounded.
- (2) Secure the services of a competent electrician when making an electrical installation.
- (3) Do not run machinery over welding cables. Protect the cables from hot objects and sharp edges.
- (4) Do not stand on wet surfaces when welding.
- (5) Use only electrode holders that are well insulated.
- (6) Wear leather gloves.

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b. Radiant Energy - Highly concentrated ultra-violet rays are transmitted during the arc welding process.

- (1) Examine the helmet and lens for cracks that would let light in.

- (2) Wear protective clothing such as high top shoes, long sleeve coveralls that button at collar and are cuffless, and welding gloves.
- (3) Cover the face and eyes with a shield or helmet before striking an arc.
- (4) Give the word "cover" to all people standing by before striking an arc.
- c. Burns - The burns received when welding are a result of coming in contact with hot metal, electrode, particles of spatter, or slag.
 - (1) Wear eye protection against flying particles of slag.
 - (2) Use pliers or metal tongs when handling hot metal.
 - (3) Dress properly.
- d. Gases and Fumes
 - (1) Welding should be done in a well ventilated shop.
 - (2) An extra fan may be needed when welding galvanized metal for the fumes are toxic.
- e. Combustible Materials
 - (1) Do not weld on containers which have held combustible materials.
 - (2) Do not weld near combustible materials such as fuel oils, cleaners, rags or trash paper.
 - (3) Properly dispose of hot electrode stubs (put them in a tray, do not throw them on the floor where they can be slipped on)
- f. Miscellaneous Safety Rules
 - (1) Do not lay the electrode holder on the welding table.
 - (2) Do not stand on or lean against grounded metal.
 - (3) Keep work area clean to avoid falling.
 - (4) Keep tools and equipment in a safe place so they will not fall on the operator.
 - (5) Do not hold the electrode holder between the knees or under the arm.
 - (6) If the electrode sticks and cannot be twisted free release the electrode holder from the electrode, cut off the machine, allow the electrode to cool and break it loose with pliers.

- (7) Do not cool electrode holder in water.
- (8) Cover eyes when chipping slag. Never rub the eyes if foreign particles get in them.
- (9) Industrial quality eye protection of the spectacle type should be worn by all persons in the shop regardless of the job being performed. This type of eye protection fits under the standard arc welding helmet and therefore need not be removed for welding.
- (10) Do not strike an arc or weld until you are sure those in the vicinity have protective equipment or will look in the other direction.

(NOTE: Yell "cover" before striking an arc)

- g. The following is a lens filtration chart which may be used in selecting the correct filtration lens for a given job.

<u>OPERATION</u>	<u>SHADE NUMBER</u>
SOLDERING	2
TORCH BRAZING	3 or 4
OXYGEN CUTTING	
up to 1 inch	3 or 4
1 to 6 inches	4 or 5
6 inches and over	5 or 6
GAS WELDING	
up to 1/8 inch	4 or 5
1/8 to 1/2 inch	5 or 6
1/2 inch and over	6 or 8
SHIELDED METAL-ARC WELDING	
1/16, 3/32, 1/8, 5/32 inch electrodes	10
<u>NONFERROUS</u>	
GAS TUNGSTEN-ARC WELDING	
GAS METAL-ARC WELDING	
1/16, 3/32, 1/8, 5/32 inch electrodes	11
<u>FERROUS</u>	
GAS TUNGSTEN-ARC WELDING	
GAS METAL-ARC WELDING	719
1/16, 3/32, 1/8, 5/32 inch electrodes	12

SHIELDED METAL-ARC WELDING

3/16, 7/32, 1/4 inch electrodes	12
5/16, 3/8 inch electrodes	14
ATOMIC HYDROGEN WELDING	10 to 14
CARBON-ARC WELDING	14

On any filtering lens which meets the standards of the law the shade number must be on the lens, therefore you should check the shade numbers to make sure they are correct.

5. Types of electrodes

- a. Mild steel (for the purposes of this class we will use two mild steel electrodes. E6011 for deep penetration and E6013 for good fill and well appearance).
 - b. High carbon steel - E7018
 - c. Hard surfacing - hard surfacing rod
 - d. Alloys - special purpose - nickel alloy for cast iron
- These you will learn how to use in upcoming years.

6. Common sizes of electrodes used in agricultural mechanics

- a. 1/8"
 - b. 5/32"
- } The larger the electrode the faster it fills and the more current required to run it

7. Meaning of numbers in the electrode classification system (Transparency 1)

- a. E - Arc welding electrode (Electric arc welding)
 - b. 60 - Tensile strength in thousand of pounds per square inch (This one has 60,000 psi tensile strength)
 - c. 1 - Position to be used
 - d. 1 - Special characteristics i.e., AC only or AC & DC or DC only, low hydrogen flux content for high carbon steel welding, etc.
- 1 - All positions
2 - Flat and Horizontal only
3 - Flat welds only

(NOTE: Refer to Table 1 for information about color coding and manufacturers "brand" names for electrodes)

8. Purposes of electrode coding

- a. Stabilizes the arc
- b. Shields molten puddle from air
- c. Floats impurities out of puddle
- d. Forms slag and slows cooling
- e. Increases speed and improves quality of weld

9. Effect of raising and lowering current

- a. Raising current - Produces more heat
- b. Lowering current - Produces less heat

(NOTE: On thicker metals more heat is necessary in order to get penetration. Refer to Table 2 for information about the effect of amperage setting and arc length.)

10. Methods of establishing an arc

- a. Scratching (similar to striking a match) - use this system to start
- b. Tapping UU can cause sticking due to stop action of tap.

11. Characteristics of proper arc length

- a. End of electrode is the same distance from the base metal as the diameter of electrode
Example: 1/8" electrode - arc length 1/8"
- b. Correct arc length makes a steady hum of the welder and a "frying" sound at the arc.
Excess arc length will yield poor penetration and excess spatter. (Refer to Table 2.)

12. Parts of the welding process (Transparency 2)

- a. Electrode
- b. Wire core
- c. Coating (flux)
- d. Arc
- e. Gaseous shield
- f. Weld
- g. Slag
- h. Heat lines
- i. Base metal
- j. Penetration
- k. Crater
- l. 15° lean in the direction of travel (pull the molten puddle behind you)
- m. Direction of travel

13. Kinds of welds (Transparency 3)

- a. Fillet
- b. Groove butt joint
- c. Bead

14. Types of weld joints (Transparency 4)

- a. Edge joint
- b. Butt joint
- c. Corner joint
- d. T joint
- e. Lap joint

15. Weld positions (Transparency 5)

- a. Flat
- b. Vertical
- c. Overhead
- d. Horizontal

16. Reasons for poor welds

- a. Machine adjustment too hot or too cold
(amperage too high or too low respectively)
- b. Electrode size too large or too small for base metal
- c. Improper movement of electrode (move too fast or slow)
- d. Improper angle of holding electrode (15° in direction of travel and 90° end view)
- e. Improper base metal preparation (dirty - grease, paint rust - bevel when thickness exceeds $1/4"$)
- f. Arc length too long or too short (the diameter of the rod is the correct arc length)

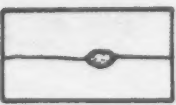
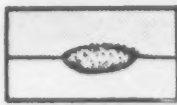
Table 1. Electrode Color Coding and Manufacturers Cross-reference

AWS Classifi- cation	Color Markings			Polarity	Manufacturer Numbers				
	End	Spot	Group		AIRCO	Lincoln	A.O. Smith	Hobart	Marquette
E6010	---	---	---	DC RP	Easy- arc 10 78	5	SW 10	#10	#105
E6011	---	Blue	---	AC DC RP	230	180	SW 14	335	#130
E6012	---	White	---	AC DC SP	387 323	Fleet- weld 7	SW 11, 12 17, 29	#12, 77, & 212	#120
E6013	---	Brown	---	AC DC SP	90	37	SW 16 or 15	447 313 13	140 151
E6014	Black	Brown	---	AC DC SP	Easy- arc 14	47	SW 15	Rocket 15	---
E7018 (Low hydrogen)	Black	Orange	Green	DC RP AC	Easy- arc 328	LH70 LH71	SW 47	111 718	LH 7016
E6024 (Iron powder)	Black	Yellow	---	AC DC RP	Easy- arc 12	Jet- weld- 1	SW 44	Rocket 24	#12
E6027 (Iron powder)		Silver		AC DC RP	Easy- arc 27	Jet- weld 2	---	Rocket 27	---
E-Nickel for cast	Orange	Blue	White	AC DC RP	375	Soft- weld	SW Nickel Nickel cast		#99
E-Steel for cast	Orange	---	---	AC DC RP	77	Ferro- weld	SW 5	Strong cast	#40

Electrode Selection According to Job Conditions:

- A. Fast-Freeze-electrode that deposits a weld that solidifies or freezes rapidly-Applicable to vertical or overhead welds. E6010 and E6011.
- B. Fast-Fill - ability to deposit metal rapidly-opposite of fast freeze electrode. E7018, E6024 and E6027.
- C. Fill-Freeze - characteristics between fast-freeze and fast-fill electrode. E6012, E6013 and E6014.

TABLE 2
ARC WELDING BEADS

WELDING SPEED TOO FAST			SMALL BEAD WITH CONTOUR IRREGULAR	NOT ENOUGH WELD METAL	WEAK WELD	WASTED ELECTRODES AND TIME
WELDING SPEED TOO SLOW			EXCESSIVE PILING UP	OVERLAPPED	WASTED TIME	WASTED ELECTRODES AND TIME
ARC TOO LONG (VOLTAGE TOO HIGH)			IRREGULAR BEAD WITH POOR PENETRATION	WELD METAL NOT PROPERLY SHIELDED	INEFFICIENT WELD	WASTED ELECTRODES AND TIME
CURRENT TOO HIGH			EXCESSIVE SPATTER	UNDERCUT EDGES	IRREGULAR DEPOSIT	WASTED ELECTRODES AND TIME
CURRENT TOO LOW			EXCESSIVE PILING UP	POOR PENETRATION	SLOW PROGRESS	WASTED ELECTRODES AND TIME
PROPER CURRENT VOLTAGE & SPEED			SMOOTH, REGULAR, WELL FORMED BEAD	NO UNDERCUTTING, OVERLAPPING OR PILING UP	UNIFORM	EXCELLENT WELD AT MINIMUM MATERIAL AND LABOR

ARC WELDING

JOB SHEET #1--START, STOP, RESTART A BEAD

I. Equipment, materials, and tools needed

- A. Piece of metal 1/4" thick, 2" x 4"
- B. Welder
- C. Electrode holder and lead
- D. Ground clamp and lead
- E. Helmet
- F. Gloves
- G. Coveralls
- H. Electrodes (E6011)
- I. Industrial quality eye protection
- J. Chipping hammer
- K. Wire brush

II. Procedure

- A. Prepare metal for welding
- B. Strike arc 1" from edge where bead is to begin (Figures 1 and 2)

FIGURE 1

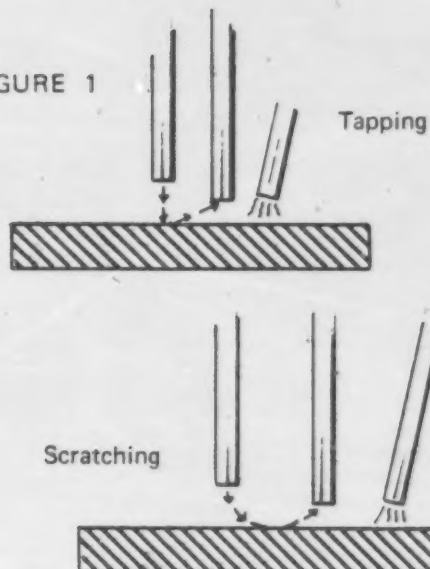
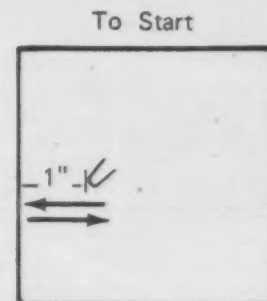


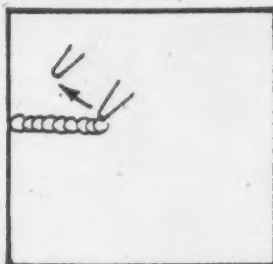
FIGURE 2



JOB SHEET #1

- C. When arc burns brightly, move to edge maintaining the correct arc length and begin forming the puddle
- D. Move across metal two inches
- E. To stop bead, move electrode back through the puddle and lift up (Figure 3)

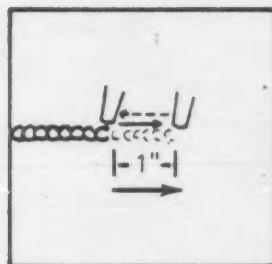
FIGURE 3 To Stop



(NOTE: This will prevent cracks from forming in the puddle.)

- F. To restart, strike arc about 1" in front of crater (Figure 4)

FIGURE 4 To Restart



- G. Move back through the crater when arc burns brightly and then resume the bead

(NOTE: This is necessary in order for beads to blend with one another without a change in continuity.)

ARC WELDING

JOB SHEET #2-CONSTRUCT A PAD

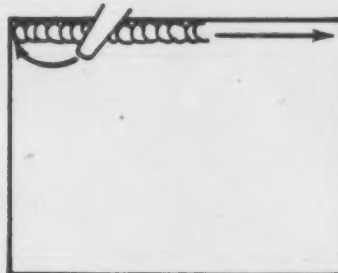
I. Equipment, tools, and material needed

- A. Piece of metal 1/4" thick, 4" x 4"
- B. Welder
- C. Electrode holder and lead
- D. Ground clamp and lead
- E. Helmet
- F. Gloves
- G. Coveralls
- H. Electrodes (E6013)
- I. Industrail quality eye protection
- J. Chipping hammer
- K. Wire brush

II. Procedure

- A. Prepare metal for welding
- B. Strike arc and move to point to begin (Figure 1)

FIGURE 1



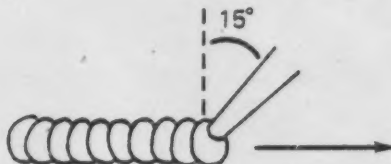
- C. Lay a straight bead across the plate using a weaving motion

JOB SHEET #2

- D. Hold electrode at a 15° angle in direction of travel and lower electrode as rod burns away to maintain correct arc length (Figure 2)

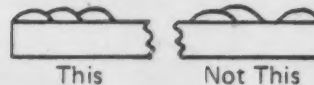
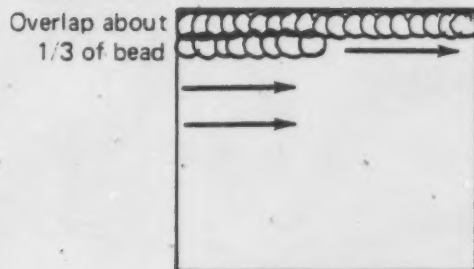
(NOTE: There should be 90° on each side of the electrode.)

FIGURE 2



- E. Move electrode steadily from right to left across pad
 F. Clean the slag from each bead before starting the next one
 G. Cool metal after each pass
 H. Run beads until pad is half full overlapping each bead (Figure 3) with E6013 and fill the other half with E6011 rod

FIGURE 3



- H. Let each bead cool until slag is black before chipping
 I. Run additional layers until desired thickness is obtained

ARC WELDING

JOB SHEET #3-CONSTRUCT A BUTT WELD

I. Equipment, tools, and materials needed

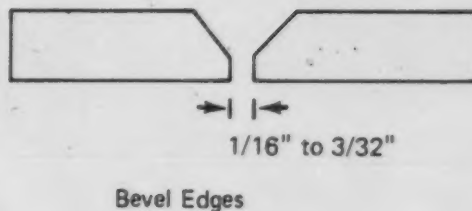
- A. Two pieces of metal, 1/4" thick, 2" x 4"
- B. Welder
- C. Electrode holder with leads
- D. Ground clamp with leads
- E. Helmet
- F. Gloves
- G. Coveralls
- H. Electrodes (E6011)
- I. Industrial quality eye protection
- J. Chipping hammer
- K. Wire brush

II. Procedure

- A. Prepare metal to be welded (Figure 1)

(NOTE: If metal thickness is over 1/4", then the edges should be beveled.)

FIGURE 1



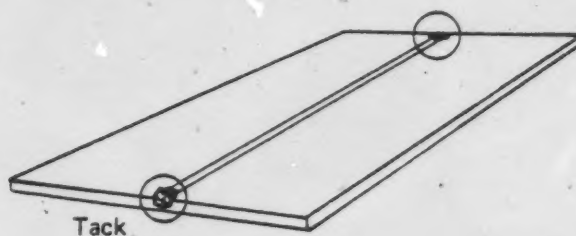
- B. Place two pieces of metal parallel to each other

(NOTE: Leave a space from 1/16" to 3/32" between them.)

JOB SHEET #3

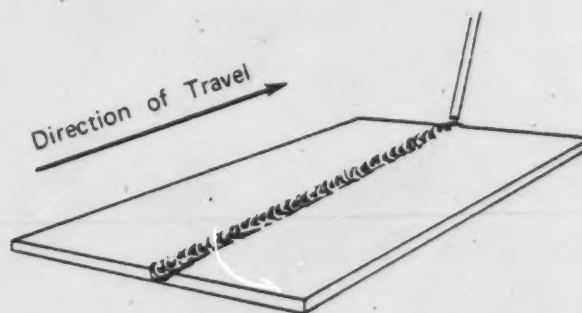
- C. Tack weld pieces together at both ends (Figure 2)

FIGURE 2



- D. Complete weld using a single pass (Figure 3)

FIGURE 3



- E. Chip slag and brush weld

ARC WELDING

JOB SHEET #4 - CONSTRUCT A T-FILLET WELD

1. Equipment, Tools and materials needed

- A. Two pieces of metal, 1/4" thick, 2" x 4"
- B. Welder
- C. Electrode holder with leads
- D. Ground clamp with leads
- E. Helmet
- F. Gloves
- G. Coveralls
- H. Electrodes (E6013)
- I. Industrial quality eye protection
- J. Chipping hammer
- K. Wire brush

II. Procedure

- A. Prepare metal for welding

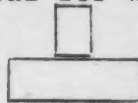


Figure 1

(NOTE: If metal thickness is less than 1/4", the edge does not have to be beveled.)

- B. Tack weld pieces together so the vertical piece approximates a 90° angle.
- C. Complete weld with a single pass; side angle should divide the angle formed by the two pieces to be welded.

End view

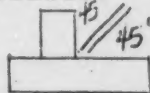


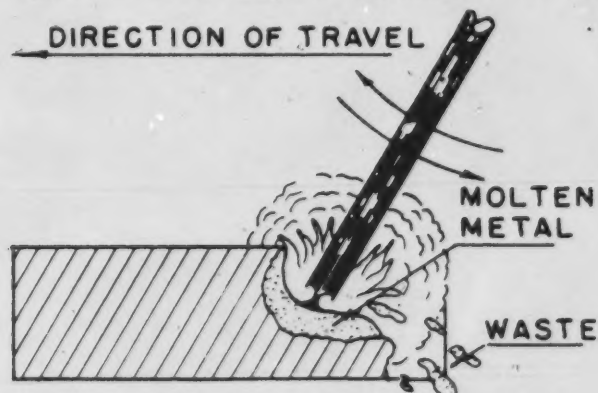
Figure 2

(NOTE: Maintain a 15° angle in the direction of travel.)

ARC WELDING

JOB SHEET #5 - CUTTING WITH THE ARC

1. Material - Piece of steel plate at least 1/4" in thickness.
2. Procedure:
 - A. Select 1/8" E6011 mild steel electrode and make an initial setting of about 180 amperes. If electrode is soaked in water about five minutes before using it is not consumed as fast.
 - B. A piece of heavy metal may be used as a guide in cutting straight lines.
 - C. Short hacking motions are used in removing the molten metal from the cut. The metal is melted on the upward stroke and the waste forced out on the downward stroke. Metal may be cut in a vertical or flat position.
 - D. Holes pierced with the arc electrode are not as accurate as drilled holes but procedure is often preferred because of greater speed. Holes can be pierced in steels difficult to drill as spring leaves, harrow teeth and cast and malleable cast.
 - E. Maintain a long arc, rotate tip of electrode until base metal becomes molten, then force tip through metal. Hole may be extended to desired size.

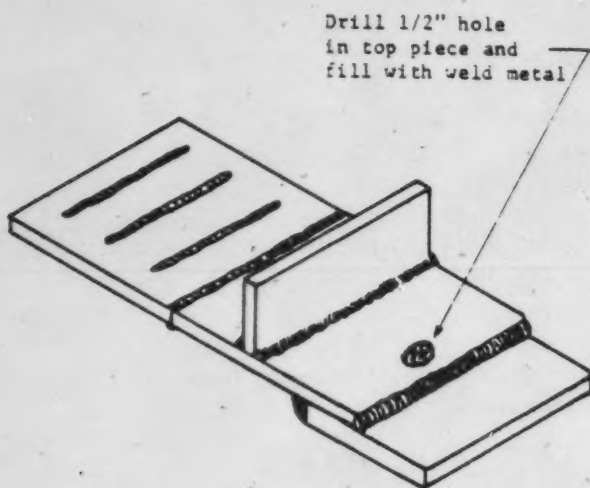


In arc cutting the metal is melted on the upward stroke and the waste forced out on the downward stroke.

ARC WELDED TROPHY

Welding Exercise

- 3 beads
- 2 butt welds
- 2 fillet welds
- 2 lap welds
- 1 plug weld



Materials:

- 3 - 4"x4"x 1/4" Steel plates
- 1 - 2"x4"x 1/4" Steel plate
- E6011, E6013, or E7018 Electrodes 1/8" size

Evaluation Score Sheet:

	Points	
	Possible	Earned
1. Three beads	25	_____
2. Two butt welds	15	_____
3. Two fillet welds	20	_____
4. Two lap welds	15	_____
5. Plug weld	10	_____
6. Freedom from distortion	10	_____
7. Work habits - attitude	5	_____
Total	100	_____

Date _____ Grade _____
 Name _____

Procedure

A. Steps in Selection of Materials and Procedures in Welding

1. Examine base metal
Type of metal, carbon content, thickness, type of weld, type of joint, appearance desired, strength needed, position of the weld.
2. Select correct electrode
Electrode number, electrode size
3. Select correct amperage
4. Select correct joint preparation
Cleaning, veeing, clamping
5. Select correct safety equipment
Safety glasses, helmet with No. 10 eye shield, leather gauntlet gloves, hard finish clothing.

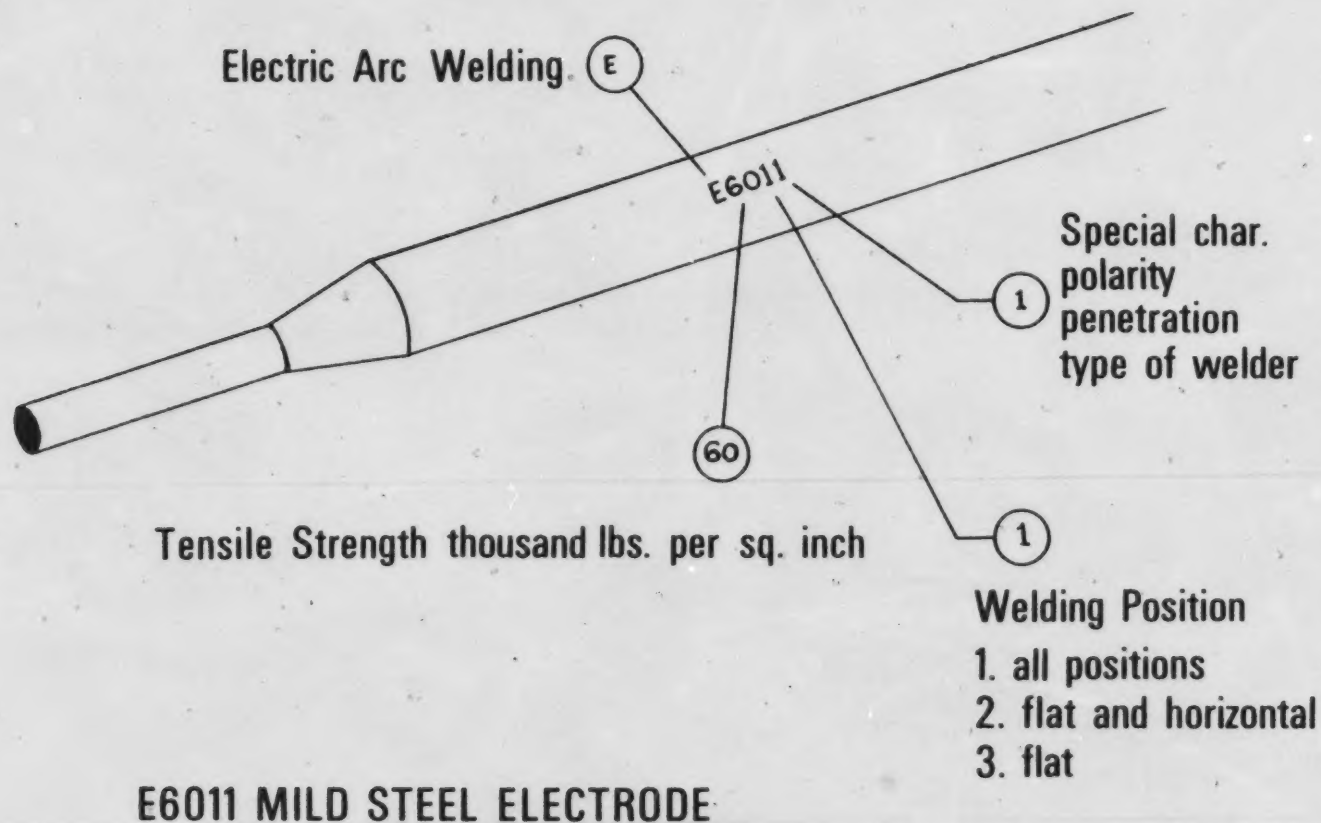
B. Steps in Making the Weld

1. Tack weld or clamp as needed
2. Strike the arc - Scratch or tap method
3. Pre-heat
4. Hold long arc until molten pool is desired size
5. Lay the bead - (a) Electrode angle -- 15° from vertical in direction of travel; (b) Arc length - 1/16" to 1/8" makes frying sound; (c) Speed of travel - watch width (2 X electrode dia.), height and shape of molten pool. Fill the Crater: E6013 - shorten the arc, reverse direction, pull out from rear of pool; E6011, raise electrode slowly or whip out with long arc and back into pool with short arc.

Questions

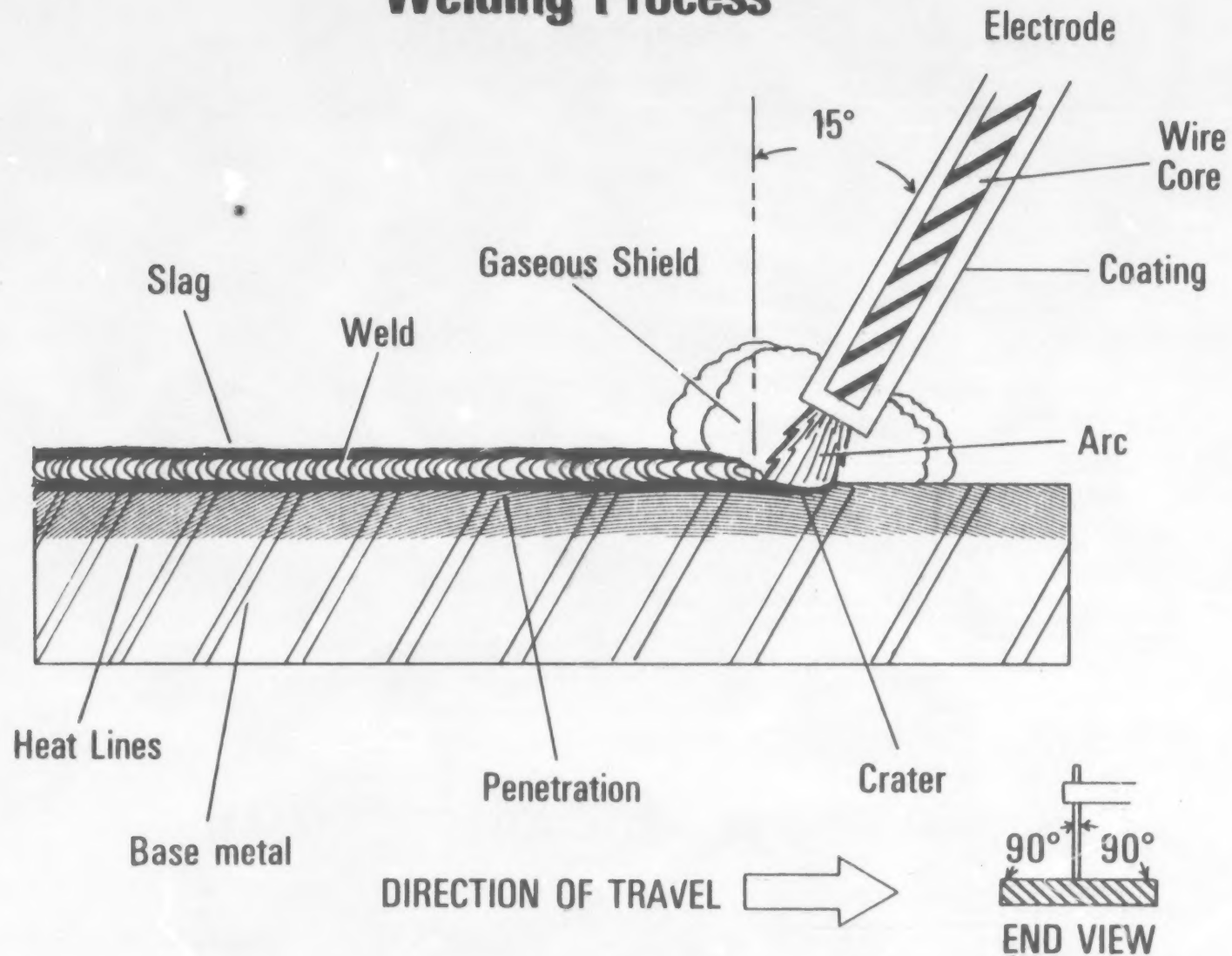
1. How does the accumulated heat caused by welding on a small mass of metal affect bead quality?
2. How does spacing of parts and/or edge preparation affect penetration?
3. Can you weld equally fast with three electrodes?
4. Why does it require more time for fillet welds than for butt welds?
5. What should you do to control distortion while welding this assembly?

AWS Classification of Electrodes



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Welding Process

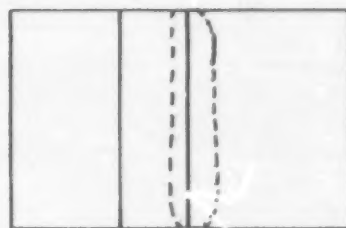
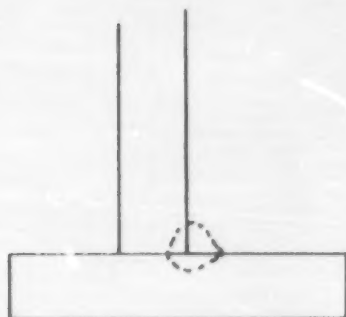


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Kinds of Welds

Fillet Weld

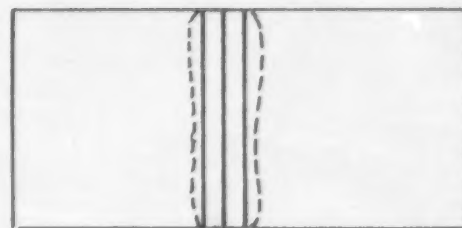


Groove Weld

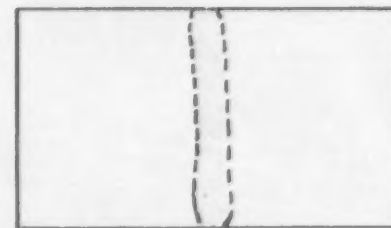
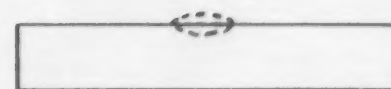
END VIEW



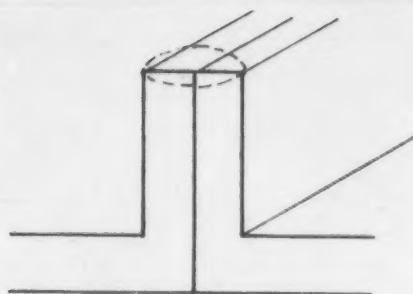
TOP VIEW



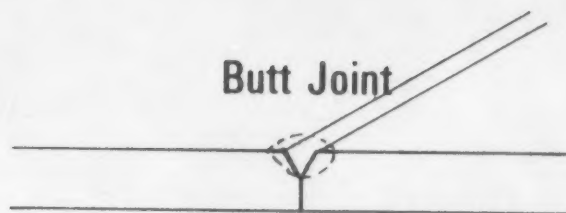
Bead Weld



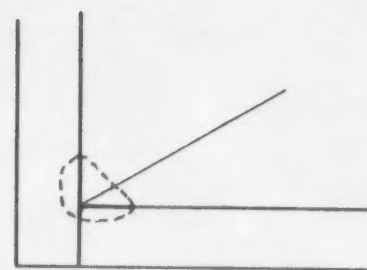
Types of Weld Joints



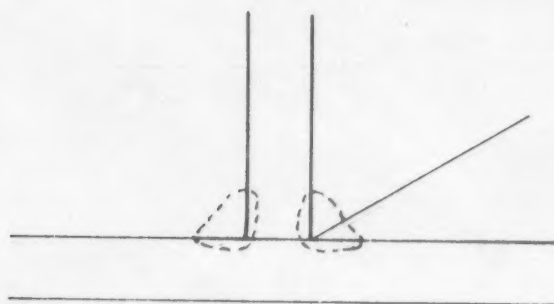
Edge Joint



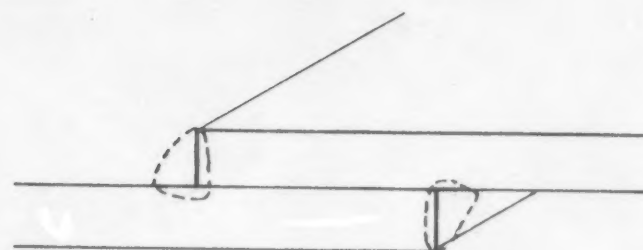
Butt Joint



Corner Joint

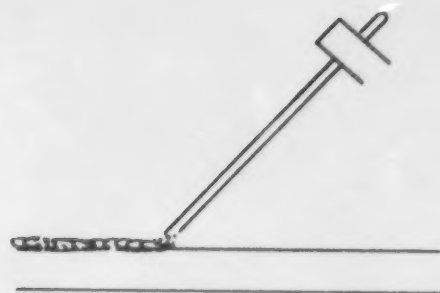


T Joint

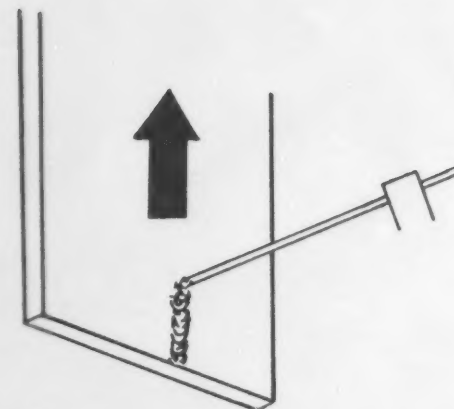
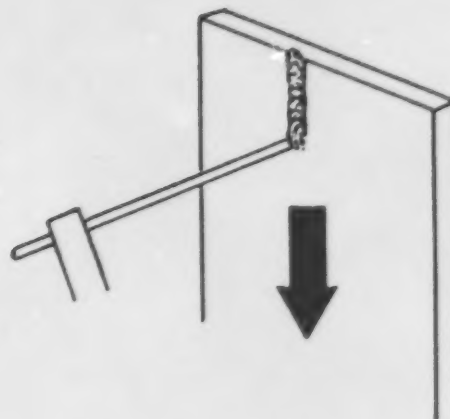


Lap Joint

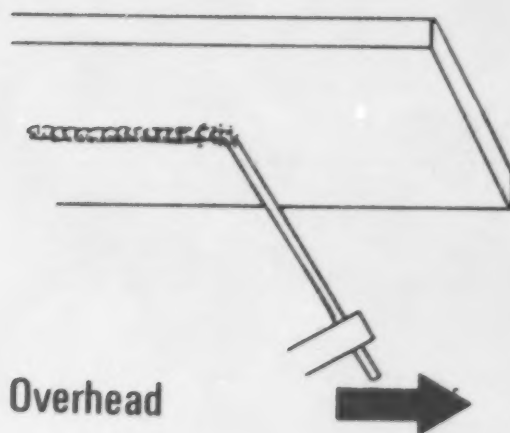
Welding Positions



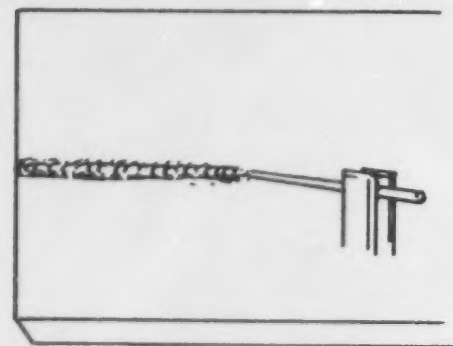
Flat



Vertical



Overhead



Horizontal

ARC WELDING

TEST

1. Match terms on the right to the correct definition.

_____ a. Metal to be welded	1. Arc
_____ b. Weld between two metal parts on the same plane	2. Base metal
_____ c. Joining of two or more pieces of metal together by the fusion process	3. Bead weld
_____ d. Flow of current across a narrow gap	4. Bevel
_____ e. Made by one pass of the electrode	5. Butt joint
_____ f. Type of edge preparation	6. Crater
_____ g. Depression at the end of the weld	7. Electrode
_____ h. Metal rod which conducts a current from the electrode holder to the base metal	8. Welding
_____ i. American Welding Society	9. A.W.S.

2. List five safety precautions used in arc welding.

- a.
- b.
- c.
- d.
- e.

3. List two kinds of arc welders.

- a.
- b.

4. Select from the following list common equipment used in arc welding by placing an "X" in the blank.

☐ a. Welder
☐ b. Torch
☐ c. Table
☐ d. Shield or helmet
☐ e. Gloves
☐ f. Ground clamp with lead
☐ g. Tape
☐ h. Wire brush
☐ i. Electrode
☐ j. Base metal

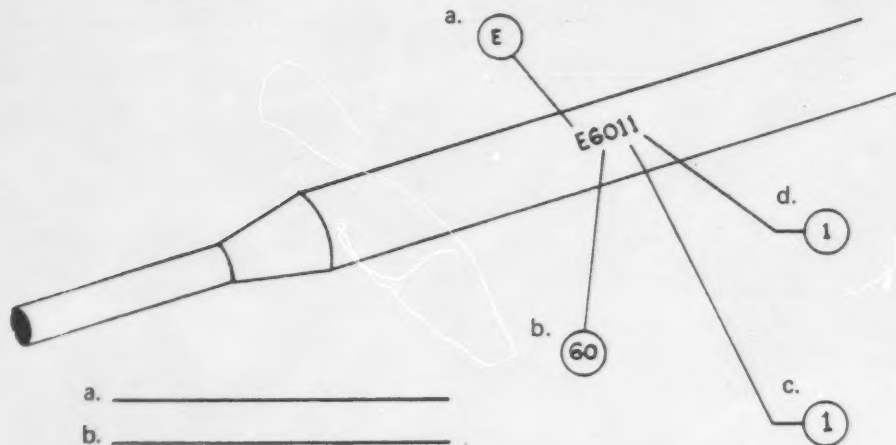
5. List four types of electrodes.

a.
b.
c.
d.

6. Place an "X" by the two most common sizes of electrode used in agricultural mechanics program.

☐ a. 1/4"
☐ b. 1/8"
☐ c. 1/16"
☐ d. 5/32"
☐ e. 3/8"
☐ f. 3/32"
☐ g. 3/16"
☐ h. 3/64"

7. Identify the meaning of the numbers in the electrode classification system from the drawing.



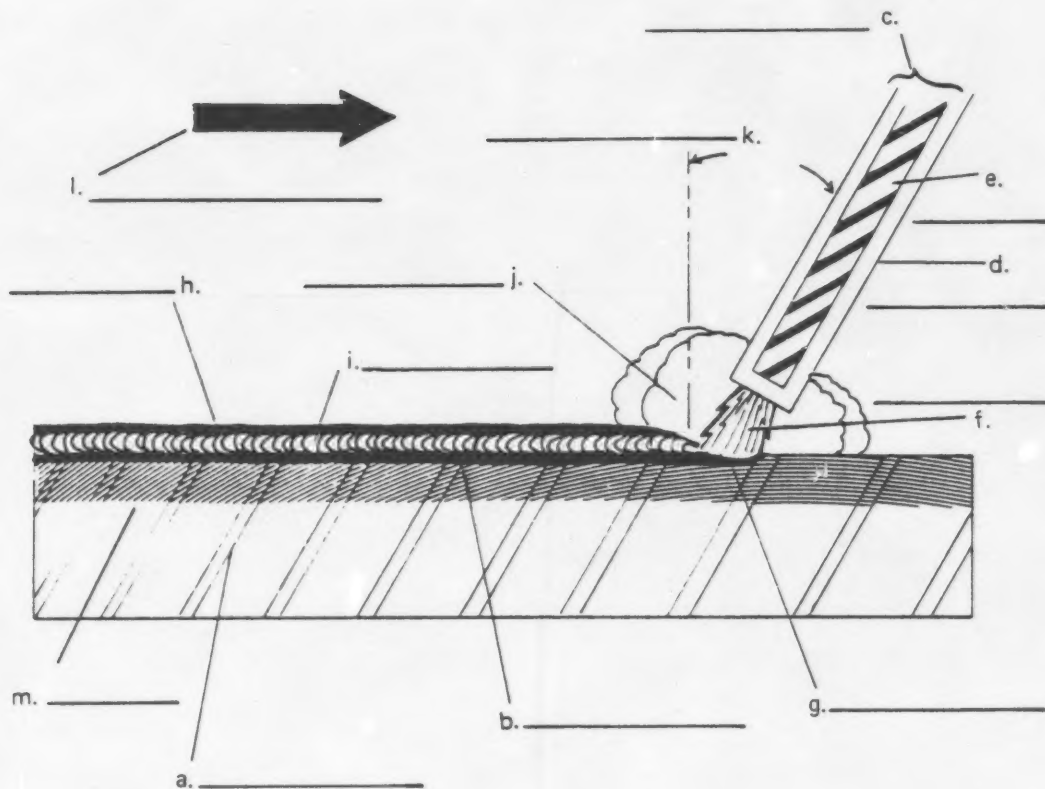
- a. _____
 b. _____
 c. _____
 d. _____

8. Name two methods of coating electrodes.
- a. _____
 b. _____
9. List three purposes of electrode coating.
- a. _____
 b. _____
 c. _____
10. Describe the effect of raising and lowering the arc welding current.
11. Name two methods of establishing an arc.
- a. _____
 b. _____

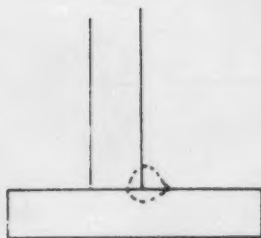
12. Select from the list below characteristics of the proper arc length by placing an "X" in the blank by the proper statements.

- _____ a. Arc length is always 1/2" long
- _____ b. Arc length is the same as the length of the electrode
- _____ c. End of electrode is the same distance from the base metal as the diameter of the electrode
- _____ d. Correct arc length makes a steady hum of the welder and a "frying" sound at the arc

13. Label the parts of the drawing associated with the welding process.



14. Identify the following welds.

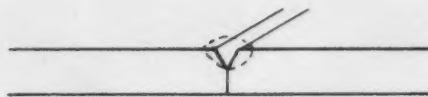


a. _____

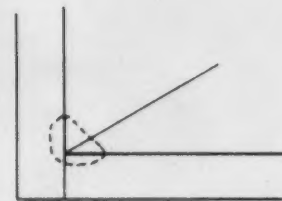
b. _____

c. _____

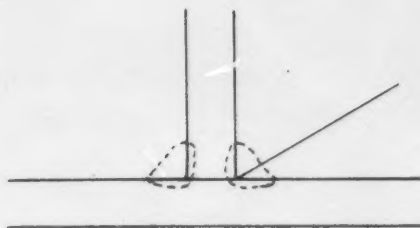
15. Identify five types of weld joints.



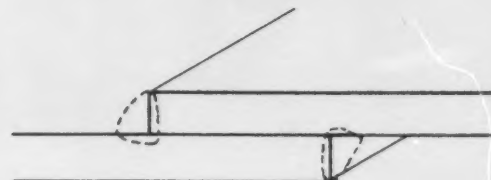
a. _____



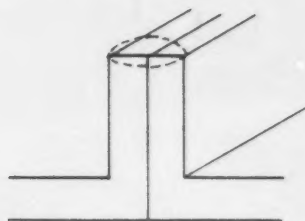
b. _____



c. _____



d. _____



e. _____

16. List four welding positions.
 - a.
 - b.
 - c.
 - d.
17. List four reasons for poor welds.
 - a.
 - b.
 - c.
 - d.
18. Demonstrate the ability to:
 - a. Start, stop, and restart a bead.
 - b. Construct a pad weld.
 - c. Construct a butt weld.

(NOTE: If these have not been completed before the test, ask the instructor when the above activities should be completed.)

ARC WELDING

ANSWERS TO TEST

1.
 - a. 2
 - b. 5
 - c. 8
 - d. 1
 - e. 3
 - f. 4
 - g. 6
 - h. 7
 - i. 9
2. Any five of the following
 - a. Never look at arc with the naked eye
 - b. Use a head or face shield that is in good condition
 - c. Wear suitable clothing to protect all parts of the body
 - d. Do not strike an arc or weld until you are sure those in the vicinity have protective equipment or will look in the other direction
 - e. Do not weld around combustible or flammable materials
 - f. Do not pick up hot metal
 - g. Do not weld in confined places without ventilation
 - h. Always open main switch or disconnect plug when checking over a welder
 - i. Do not leave electrode holder on welding table or in contact with grounded metal surface
 - j. Do not use worn or frayed cables
 - k. Stand on dry footing when welding
 - l. Keep area around welder clean

- m. Keep tools and metals in their proper locations
- 3. Any two of the following
 - a. A.C.
 - b. D.C.
 - c. TIG
 - d. MIG
- 4. a, d, e, f, h, i
- 5. a. Mild steel
 - b. High carbon steel
 - c. Hard surfacing
 - d. Alloys--Special purpose
- 6. b, d
- 7. a. Arc welding electrode
 - b. Tensile strength
 - c. Welding position
 - d. Special characteristics
- 8. Any two of the following
 - a. Wrapping
 - b. Dipping
 - c. Extruding
- 9. Any three of the following
 - a. Stabilizes arc
 - b. Shields molten puddle from air
 - c. Floats impurities out of puddle
 - d. Forms slag and slows cooling
 - e. Increases speed and improves quality of weld

10. Description should include:
 - a. Raising current--Produces more heat
 - b. Lowering current--Produces less heat
11.
 - a. Scratching
 - b. Tapping
12. c, d
13.
 - a. Base metal
 - b. Penetration
 - c. Electrode
 - d. Coating (flux)
 - e. Wire core
 - f. Arc
 - g. Crater
 - h. Slag
 - i. Weld
 - j. Gaseous shield
 - k. $15^{\circ} - 30^{\circ}$
 - l. Direction of travel
 - m. Heat lines
14.
 - a. Fillet
 - b. Groove
 - c. Bead
15.
 - a. Butt
 - b. Corner
 - c. T
 - d. Lap
 - e. Edge

16.
 - a. Flat
 - b. Vertical
 - c. Overhead
 - d. Horizontal
17. Any four of the following
 - a. Machine adjustment too hot or too cool
 - b. Electrode size too large or too small
 - c. Improper movement of electrode
 - d. Improper angle of holding electrode
 - e. Improper base metal preparation
 - f. Arc length too short or too long
18. Performance skills will be evaluated to the satisfaction of the instructor.

INTRODUCTION TO OXYACETYLENE CUTTING

OBJECTIVES

Upon completion of this unit, the student should be able to:

1. Define terms associated with oxyacetylene cutting and welding.
2. List five safety precautions to observe when handling oxyacetylene equipment.
3. Identify parts of oxyacetylene cutting and welding equipment.
4. Identify three types of flames.
5. Demonstrate the ability to:
 - a. Set up the oxyacetylene equipment.
 - b. Turn on, light, adjust to a neutral flame, and turn off the oxyacetylene equipment.
 - c. Run a puddle without filler rod.
 - d. Weld a fusion butt with a rod.
 - e. Braze butt weld.
 - f. Cut a straight line.

Instructor Activities

1. Provide student with objective sheet, at instructor's discretion.
2. Make transparencies.
3. Discuss terminal and specific objectives.
4. Discuss technical and safety information.
5. Demonstrate and discuss procedures outlined in job sheets.
6. Give test - optional.

(NOTE: The unit can be presented as one or two weeks in length; if you want a one-week unit, do the puddle without filler rod and weld with rod; for a two week unit add the braze weld and cut.)

Student's Activities

1. Read objectives.
2. Study technical information and take notes.
3. Complete the procedures outlined in the job sheets.
4. Take test.

Teaching Outline:

OXYACETYLENE CUTTING & WELDING1. Facts about Oxygen and Acetylene

- a. Oxygen is colorless, odorless, tasteless, and is heavier than air. Oxygen makes up about 20% of the atmosphere. Oxygen itself will not burn, but when mixed with combustibles it becomes highly explosive. Oxygen is considered a supporter of combustion. It is produced commercially by causing air to liquify and using fractional distillation to recover the oxygen. The common means of containing it is the steel cylinder into which the gas is compressed to a pressure of 1800 to 2400 pounds per square inch. Care should be taken in handling the cylinder due to the fact that it supports combustion and is contained in cylinders at very high pressure. The cylinder size ranges from 80 to 244 cubic feet.
- b. Acetylene is colorless but has a very distinct odor. Acetylene gas is composed of carbon and hydrogen and is highly combustible. Acetylene cylinder sizes range from 60 - 300 cubic feet. Inside the acetylene cylinder is a porous substance saturated with liquid acetone. The acetylene gas is not under extremely high pressure like the oxygen. Acetylene is under a full cylinder pressure of only 250 pounds per square inch. Acetylene burns in the cone of the flame and the flame envelope. The end of the inner cone may produce a neutral flame temperature from about 6000 degrees F.

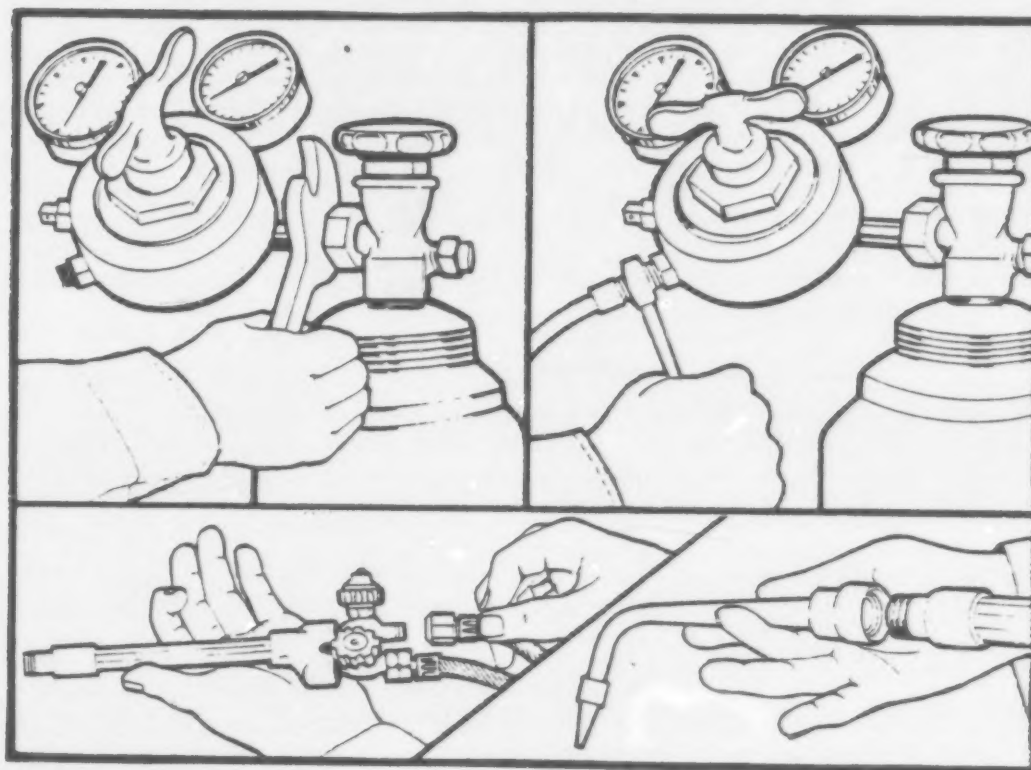
2. Functions of Oxyacetylene Heat

- a. Oxyacetylene cutting is a process used to separate metal by heating it to a kindling temperature between 1400 and 1800 degrees F., then oxidizing and blowing the metal from the cut with a stream of oxygen.
- b. Oxyacetylene welding is fusing two pieces of metal together by heating them to the melting point (low carbon steel 2700°F) by a combustion mixture of oxygen and acetylene. This process can be done with or without the use of a welding rod.
 - (1) The joining of metals by adding bronze as a filler is known as brazing.
 - (2) Soft and hard solders (lead and silver alloys) are the filler materials used in soldering.

- c. The oxyacetylene flame is also used to bend, shape, preheat, postheat, and temper metals.

3. Procedure for Assembly of the Oxyacetylene Rig

- a. Secure the oxygen and acetylene cylinders to a wall, a special cylinder truck, or a special rack if transported to job sites in a pickup truck.
- b. Remove the valve protection caps and wipe off any dirt accumulation with a clean dry cloth (free from oil or grease).
- c. Slightly open (crack) both cylinder valves to make sure they do not stick and to blow out any dirty or dust lodged in the valve. Close the valves.
- d. Attach the regulators to the cylinders to that they point toward the ceiling to prevent someone from getting in front of the regulator.
- e. The regulators, safety check vales, and hoses should be tightened securely with a wrench.
- f. The welding tip or cutting attachment should not be tightened to the torch with a wrench.
- g. Check for leaks with mild soapy water with a clean paint brush. All valves, connections and soft plugs should be checked.



4. Safety Precautions for Oxyacetylene

- a. Keep oil and grease away from all parts of the welding and cutting apparatus.
- b. Secure the cylinders in an upright position so they cannot be overturned.
- c. Face the regulator gauges up toward the ceiling, making it impossible to stand in front of them.
- d. Store and use oxyacetylene units in well ventilated areas.
- e. Acetylene pressure in the lines should never exceed 15 pounds per square inch.
- f. Open the acetylene cylinder valve 1/4 to 1/2 turn.
- g. Use a friction spark lighter to light the torch; never use matches or cigarette lighters.
- h. Never use oxygen in pneumatic tools, to blow out lines, air up tires, or dust off clothing.
- i. Never hang clothing on cylinders, running the risk of saturating them with oxygen and acetylene.
- j. Do not convert an acetylene regulator to an oxygen regulator or vice versa.
- k. Slowly open the oxygen cylinder valve to prevent a sudden surge.
- l. Release or loosen the regulator adjusting screw before opening a cylinder valve.
- m. Do not walk with a lighted torch or lay down a lighted torch.
- n. Blow out hoses before attaching the torch.
- o. Repair hoses with proper hose splicers, not friction tape. Never use a leaky hose.
- p. Test for leaks with soap and water, not matches.
- q. If valves on cylinders are faulty or too tight, notify the supplier; undue force would be dangerous.
- r. Keep a fire extinguisher handy at all times.
- s. Dress properly and wear eye protection.
- t. Prevent heat and sparks from getting to cylinders and hoses.
- u. Do not arc on or hit a cylinder with a metal object.
- v. Never use a cylinder as a ground in an electrical circuit.
- w. Never make a guess; get the correct information from a qualified person.
- x. Mark or otherwise designate empty cylinders.

5. Procedure for Turning on the Oxyacetylene Rig
- Valves on the torch body should be closed.
 - The adjusting screws on the regulators must be loose.
 - Turn on acetylene cylinder valve $1/4 - 1/2$ turn.
 - Tighten the acetylene regulator adjusting screw to the desired working pressure (if equal pressure tips are used, one pound above the number on the tip is the correct setting.)
 - Open the oxygen cylinder valve all the way.
 - Tighten the oxygen regulator adjusting screw to the desired working pressure. (If equal pressure tips are used, one pound above the number on the tip is the correct setting.)
 - If the cutting attachment is being used, open the torch body oxygen valve all the way (usually regulator pressures of --Acetylene 6-8 psi, oxygen 20-25 psi are sufficient for cutting).
 - Slightly open the acetylene torch valve and light. Blow the flame off the tip and slowly adjust it back.
 - Adjust to a neutral flame with the oxygen valve. The oxygen pressure can be 3 - 10 times higher than the acetylene pressure when cutting. Never exceed 15 pounds pressure per square inch on acetylene. When welding, the ratio of oxygen to acetylene is approximately 1:1. Oxygen and acetylene settings will vary depending on the attachment tip and thickness of metal to cut or weld.

Acetylene Flame
(no oxygen)



Carburizing Flame
(excess acetylene)



Neutral Flame
(rounded cone, quiet sound, equal oxygen and acetylene)



Oxidizing Flame
(pointed cone, hissing sound due to excessive oxygen)



6. Procedure for Turning Off the Oxyacetylene Rig

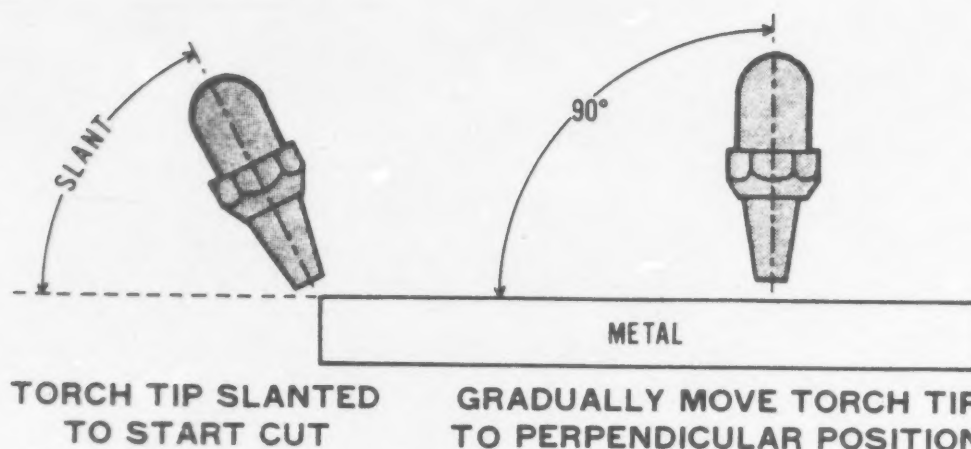
- a. Turn off the acetylene at the torch body (the flame will go out and the oxygen will blow out the carbon).
- b. Turn off the oxygen at the torch.
- c. Turn off the acetylene cylinder valve.
- d. Bleed the acetylene hose and regulator, then close the torch valve (both gauges will drop to zero).
- e. Screw out the acetylene regulator adjusting screw until loose.
- f. Turn off the oxygen cylinder valve.
- g. Bleed the oxygen hose and regulators and close the torch valve (both gauges will drop to zero).
- h. Screw out the oxygen regulator adjusting screw until loose.
- i. Re-check the valve and roll up the hose. If rig is not to be used for some time, remove the regulators and put the safety caps back on the cylinders.

7. Cutting Metals

- a. The metal to be cut should be clean, marked with soapstone, and placed in a suitable position for cutting. Do not cut over a concrete floor to prevent damage where hot metal falls. Use a container or special cutting table device to catch the molten metal. Hot metal can damage hoses and cause fires.
- b. Oxyacetylene cutting is limited to ferrous metals such as carbon steels, alloy steels, low chromium steels, and manganese steels. Steels with a high tungsten or chromium content or stainless steel cannot be cut with oxyacetylene.
- c. The steps to follow in making a cut are:
 - (1) Hold the blow pipe perpendicular to the surface of the metal unless bevels are to be cut. Hold the flame inner cone about 1/16 to 1/8 inch above the plate. The proper distance away from the plate will prevent metal from sticking to the tip. Hold the tip so that preheat holes are in line with the cut.

(SEE DIAGRAM NEXT PAGE)

CUTTING METAL



**TORCH TIP SLANTED
TO START CUT**

**GRADUALLY MOVE TORCH TIP
TO PERPENDICULAR POSITION**

- (2) Hold the torch at the edge of the metal until the metal turns red. The top of the torch may be slanted toward the cut and changed to a vertical position as the cut progresses.
 - (3) Press down slowly on the oxygen cutting lever until the cutting valve is completely open. When the cut is through the metal, move the torch along the mark.
 - (4) Tilt the torch tip toward the direction of cut on the thin metal. It should be held vertical on thick metal.
 - (5) Move the torch slowly along the surface or the oxygen stream will not pass completely through thick metal. The cut can be restarted by reheating the metal again before pressing the cutting lever. Irregular edges may be caused by losing the cut.
 - (6) When beveling plate edges or cutting at an angle, lean the tip at the desired angle and hold the torch parallel to the work.
- d. Steps that may be followed when piercing holes include:
- (1) Hold the blow pipe tip at an angle to the surface until a spot on the surface begins to melt.
 - (2) Raise the torch until the tip is about $\frac{1}{2}$ inch from the surface and slowly press the lever as the torch is raised (caution: melt will spray in the direction the tip is pointed).
 - (3) Move the tip to one side of the heated area so that the slag can be blown out.
 - (4) Move the inner cone within about $\frac{1}{8}$ inch from the surface and make the cut on the inside edge of the hole.
 - (5) To facilitate the cutting of a hole in thick metal, drill $\frac{1}{4}$ inch hole with a twist drill and

start on the edge of this hole.

8. Care of Cutting and Welding Tips

- a. Tips frequently become spattered with metal or other materials that may cause inferior work. Tips are cleaned in the following manner:
 - (1) The tip point can be cleaned and squared by rubbing with emery cloth, steel wool, or the the file on a tip cleaner.
 - (2) Insert the correct size cleaner into each orifice. Push in and pull out; do not twist or bend the cleaner.
 - (3) Open oxygen slightly after this procedure to blow out foreign particles.
 - (4) Care should be taken not to damage the threads and seats of the tips.

9. Preparing Metal For Welding

- a. Remove oil, paint, grease, dirt, rust, and other foreign material.
- b. Metal heavier than 12 guage should not be welded with O-A equipment - arc welding is cheaper and faster.
- c. Align the plates to be welded and tack them to prevent warping.

10. Proper Welding Tip Positions

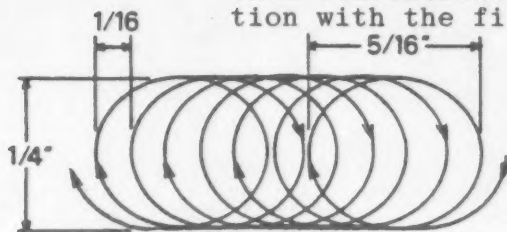
- a. The blowpipe can be held like a hammer when standing or like a pencil when working in the sitting position.
- b. The tip should be held at a 45-degree angle facing the direction of travel (push the puddle). The welding rod should also be held at a 45-degree angle to the surface opposing the torch angle.
- c. The inner cone flame should be 1/8 inch above the metal.
- d. Preheating the metal is very important in making a successful weld; therefore, the flame should be moved in the direction of the weld, and the cone should stay inside the puddle.

11. Oxyacetylene Welding Procedures

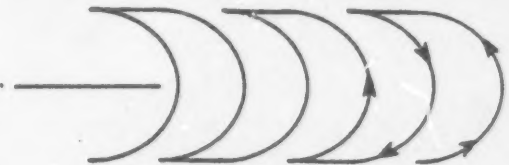
- a. One of the most important steps in learning to weld with oxyacetylene is to carry a molten puddle of metal along the line or seam of parts to be joined. Forming the puddle and running the bead include the following practices:
 - (1) The flame is held at the starting point until a bright round pool ($\frac{1}{4}$ to $\frac{3}{8}$ inches in diameter) is formed. The width of the puddle is determined by the motion of the tip and

penetration. The welding speed should be adapted to maintain a uniform puddle width. The inner cone is held $1/8$ inch above the surface. If the speed is too slow, the flame will burn a hole through the metal or form a large puddle. If the speed is too fast, the bead will be irregular and narrow.

- (2) The most common movement pattern is the circular motion, especially when fusion welding. The zigzag motion is used when fusion welding, but with the use of a filler rod. One can weld very successfully with no motion, for some people no motion with the torch hand helps them concentrate on the proper up and down motion with the filler rod.

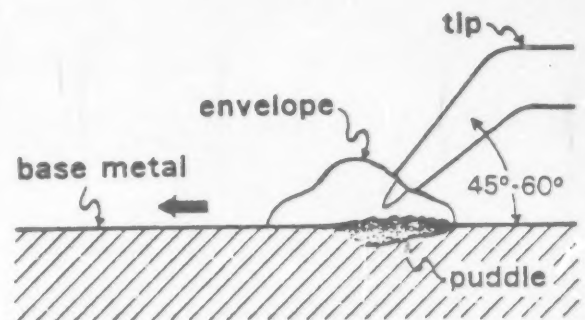
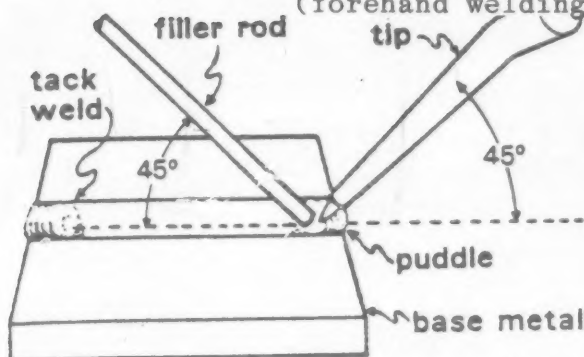


CIRCULAR MOTION



ZIGZAG MOTION

When using either pattern, the torch should be held at about 45 degrees to the surface. The welding rod should be held at 45 degrees, but slanted away from the torch tip. The rod diameter should be equal to the thickness of the metal. The torch may be held so the tip is pointed in the direction of the weld (forehand welding).



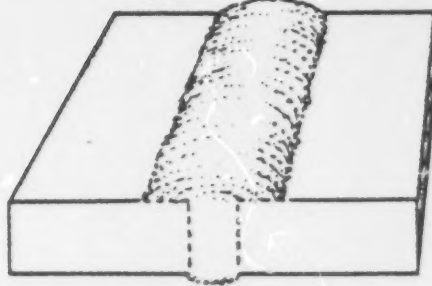
- b. When using a welding rod to make a fusion weld the following procedure may be used:

- (1) Select two pieces of 14 or 16 gauge, 2" x 3" sheet metal and a $1/16$ -inch filler rod.
- (2) Space them about $1/16$ inch apart and tack weld.
- (3) With the torch in one hand and rod in the other, heat the two pieces at the starting point and heat the rod before dipping it into the molten metal. Make an up and down motion of the rod and at the same time move the torch forward at a slow even rate of pace.

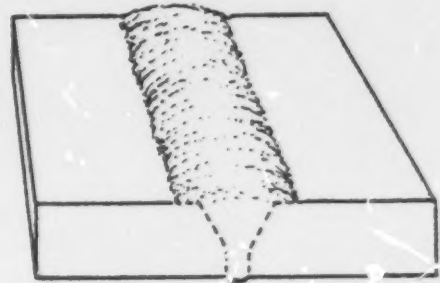
- (4) As the second tack weld is reached, remelt it into the puddle.

12. Types of Weld Joints

Most weld joints are either butt or fillet. When two pieces of metal are butter together and welded, with or without beveling, the term used for this practice is butt welding.

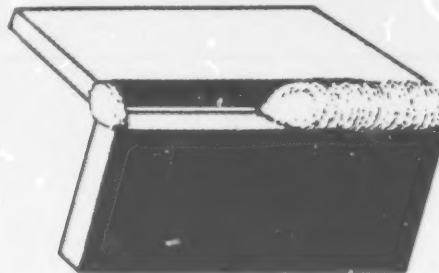


BUTT WELD

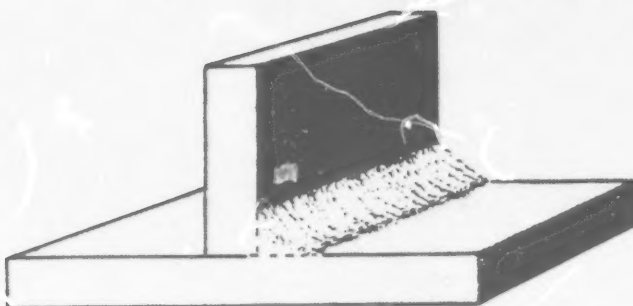


BEVELED BUTT WELD

If the metal pieces are joined together forming an angle, this is known as fillet welding.



CORNER WELD



TEE WELD



LAP WELD

13. Brazing

- (1) Practice procedure for braze welding

The main advantage to braze welding is that it does not require an extremely high welding temperature that may change the malleable properties of the metal.

- (a) Clean the surface to be welded.
- (b) Bevel and align edges of the metal.
- (c) Use neutral or slight oxidizing flame and heat the end of the rod and dip into the flux.
- (d) Heat the area to be brazed to a dull red and tack ends.
- (e) Apply flux from rod on heated area, then pass rod into flame and deposit a small amount of bronze at intervals until the weld is complete. Add flux from time to time.

SUGGESTED STUDENT ACTIVITIES

1. Fill in the blank.

- A. _____ is colorless, odorless, tasteless, and will support combustion.
- B. Full cylinder pressure for oxygen is _____ to _____ pounds psi.
- C. Full cylinder pressure for acetylene is approximately _____ pounds psi.
- D. The end of the inner cone may produce a natural flame temperature from about _____ to _____ degrees F.
- E. Besides cutting and welding, the oxyacetylene flame is used to _____, _____, _____, _____, and _____.
- F. Check for leaks with mild _____ and a paint brush.
- G. The regulator adjustment pressure for oxygen and acetylene will vary depending on the _____ size and _____ thickness.
- H. A _____ flame has a rounded inner cone, quiet sound, and an equal mixture of oxygen and acetylene.
- I. While cutting and welding the tip of the inner cone should be held _____ to _____ inch above the metal.

II. True or False

- _____ A. Oxyacetylene rigs can weld only thin metal.
- _____ B. Oxygen cylinders are equipped with double seated valves and should be opened all the way.
- _____ C. Acetylene cylinders not having the wheel type valve opener should be opened less than one turn.
- _____ D. Pressure in the acetylene hose line should never exceed 15 psi.
- _____ E. Open the regulator valve prior to opening the high-pressure valve on the oxygen cylinder.
- _____ F. Goggles need not be worn when working with oxy-acetylene.
- _____ G. Matches may be used for lighting the torch.
- _____ H. An oily wipe cloth should be used to clean out the oxygen cylinder fittings.
- _____ I. Always bleed hoses and loosen regulator valve screws when work is completed.
- _____ J. In fillet welding, overheating may be avoided by frequently dipping the torch into a bucket of water.
- _____ K. In brazing, or bronze welding, a flux must be used.

- _____ L. In cutting, a neutral flame is used.
- _____ M. Cutting metal should be done over concrete floors.
- _____ N. Stand in front of gauges while opening cylinders.

III. Following demonstration by the instructor, the student should briefly discuss and complete the following:

- A. Assembly of the oxyacetylene rig
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
- B. Turn on and adjust the oxyacetylene rig
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
 - 8.
 - 9.
- C. Complete shut-down of the rig
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
 - 8.

IV. Skill sheet for cutting with oxyacetylene

- A. Material: Mill steel, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 inch thick.
- B. Objective: Cutting
- C. Procedure:
 - 1. Clean the metal and mark the line to be cut.
 - 2. Properly position the metal so that molten metal and sparks will fall into a container.
 - 3. Select the correct tip and properly align the orifices.
 - 4. Set the pressure and adjust to a neutral flame.
 - 5. The cut can be made free hand or with a guide.
 - 6. Tilt or angle the torch depending on the thickness of the metal.
 - 7. Cut in a straight line.
 - 8. Cut a semicircle.

and general purpose flux.

B. Objective: Braze Welding with Filler Rod

C. Procedure:

1. Clean and position the metal.
2. Set torch to a neutral flame
3. Heat the end of the rod and dip it into the flux until it is well coated.
4. Bring surface of steel to a cherry red heat (no puddle when brazing).
5. Start adding brass filler rod - if excessive white smoke is given off the base metal is too hot.
6. Carry a molten brass puddle across the base melt.

9. Cut a circle.
10. Pierce a $\frac{1}{4}$ -inch hole.
11. Cut a 90-degree angle on a 2-inch pipe.
12. Cut a saddle on 2-inch pipe.

V. Skill sheet for welding and brazing with oxyacetylene

Part 1:

- A. Material: 14-guage sheet steel, 4 x 6 inches
- B. Objective: Form and Run a Puddle
- C. Procedure:
 1. Adjust flame to neutral at the desired temperature.
 2. Produce a live puddle ($\frac{1}{4}$ -3/8 inches in diameter)
 3. Hold the tip at a 45-degree angle to the metal pointed in the direction of travel.
 4. Using the oscillating motion, move the puddle in a straight line at the proper speed.
 5. Examine the result for uniformity.

Part 2:

- A. Material: 14-guage sheet steel, 2 pieces - 4 x 6 inches
- B. Objective: Fusion Welding Without a Rod
- C. Procedure:
 1. Position the two pieces of metal at a right angle and tack weld the ends with a neutral flame.
 2. A corner fillet joint will be formed.
 3. Establish a live puddle.
 4. Using the neutral flame pointed in the direction of travel, begin oscillating the tip.
 5. Move at a speed that allows the puddle to properly advance.
 6. Examine for flaws and uniformity.

Part 3:

- A. Material: 14-guage sheet steel and mild steel welding rods (copper coated to prevent rusting while in storage)
- B. Objective: Fusion Welding With Filler Rod
- C. Procedure:
 1. Position metal joint and adjust torch flame to neutral.
 2. Produce a live puddle.
 3. Insert end of rod into the center of the puddle directly under the blue innercone and proceed to build a bead by oscillating both the rod and the torch, which are held at 45-degree angles to the surface, and move forward at an even speed.

Part 4:

- A. Material: 14-guage sheet steel; brazing rods;

BASIC WOODWORKING

OBJECTIVES

Upon completion of this unit, the student should be able to:

1. Identify parts of power and hand tools used on the project constructed.
2. Correctly and safely operate tools after instructor demonstration.
3. Correctly fasten project parts together using screws or other fasteners.
4. Work safely in the shop woodworking area.
5. Demonstrate ability by completing a woodworking project of:
 - a. Instructor's choice
 - b. Class choice.

*NOTE: It is suggested that all students do the same project. This simplifies material procurement, student supervision, grading, and keeping all students time of completion nearly the same. However, instructor discretion is suggested with individual student needs and interests.

6. Projects

1. Sawhorse
2. Concrete float
3. Tool and hardware box

Instructor Activities and Teaching Suggestions

1. Secure Instructor's Packet, "Power Tool Safety and Operation," Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112, Catalog #273, Cost \$11.00.
2. Use student materials, transparency masters and safety exams from the above packet. (Purchase student handbook as necessary).
3. Teach correct and safe procedure for the use of each tool that is to be used on the project.
4. Demonstrate correct and safe procedure for the use of each tool that is to be used on the project.
5. Information provided here-in is on safe use of various hand tools. Present information and demonstrate correct and safe use of those hand tools which will be used on the project completed by the class.
6. Supervise student work as they construct their projects.

7. It is suggested that if there are more than 15 students in the class that one or two shop aides be used to help with student supervision (junior or senior student skilled in shop practices).
8. Give safety test on all power equipment used during the project. Students must pass safety test with 100 percent to go in the shop. Keep the safety tests on file for liability protection.

Student Activities

1. Participate in discussions and demonstrations.
2. Complete study guides if used.
3. Pass safety test with 100 percent score.
4. Complete skill building project.

References

1. Wakeman, J.J., Modern Agricultural Mechanics, 1977, Interstate.
2. "Power Tool Safety and Operation," Hobar Publications.
3. Hand tool packet - this unit source, Student Manuals Texas A&M University

Project Plans

1. All project plans may be secured from Herb Hansen, Agricultural Mechanization Specialist, Gilmore Hall, Oregon State University, Corvallis, Oregon 97331.
2. Project plans are included at the end of the Agricultural Mechanization unit, you may duplicate these plans yourself at reduced cost.

Teaching Outline

1. Show those power tools which are to be used on the project.
 - a. Bench saw
 - b. Radial arm saw
 - c. Portable circular saw
 - d. Portable electric drill
2. Using the Hobar Publication materials.
 - a. Student worksheet
 - b. Transparency masters
 - c. Teaching outline
 - d. Safety tests

Prepare presentation and demonstration on those power tools used during the construction of this project.

3. Upon completion of the instruction and demonstrations give safety test- keep them on file- student must pass with 100% in order to work in the shop (if they don't get 100 percent the first time let them take it again).
4. Distribute project plan and layout a procedure for the students to follow.
 - a. Securing material
 - b. Step by step procedure for completion of project.
5. If students complete the project before the two week rotation period, utilize additional units provided to fill time and provide extra credit.
 - a. Fasteners - test upon completion.
 - b. Rope work - do knots and make halter.
 - c. Soldering - develop simple seam and hole patch project.
 - d. Computation of Bills of Materials.
 - e. Measuring and Marking Devices.
 - f. Bolting, Measuring, and Removing Broken Bolts.
 - g. Soldering
 - h. Cutting Cold Metal
 - i. Filing Cold Metal
 - j. Bending and Shaping Metal

HAND TOOLSA. Nail Hammers and Wrecking Bars

Suggested Procedure and Activities: During the class discussion, a demonstration on the use of the hammer and wrecking bar may be presented with transparencies on the use of a hammer.

Transparency No. 11. Selecting Nail Hammers

- a. The most common nail hammer used in the agricultural mechanics shop is the curved claw hammer. The second most common hammer is known as the rip hammer or the straight claw hammer.
- b. The most common weights of nail hammers range from 13 to 20 ounces, although some hammers can be found as light as seven ounces. A 16-ounce hammer is the most popular, and it is known as the standard hammer size. The size of the nail will determine the weight of hammer to select for use.
- c. The claw hammer is used for driving and pulling nails. It is better for pulling nails than the rip hammer. Rip hammers are used mainly to dismantle or tear down structures made of wood and to drive nails.
- d. Hammers may be selected according to face. Bell-face hammers are used to drive the nail head flush with the surface of a board. The face is round or convex; therefore, hammer marks are not left on the board if the hammer is used properly. Plain-face hammers are easier to use than bell-faced hammers, but hammer marks may show up on the board due to the flat face of the plainface hammer.
- e. Most nail hammers have wood handles. Wood helps to absorb the shock that enters the arm from the hammer blow. Shock causes the arm to tire quickly.

Transparency No. 12. Parts of Nail Hammers are Important

- a. It is important to know the parts of nail hammers in order to make the proper selection for use.
- b. The parts are:

Handle	Adze eye
Claw	Check
Face	Poll
Neck	Head

Transparency No. 23. Using Nail Hammers

- a. Driving Nails - The following steps should be observed when driving nails:

The hammer handle should be grasped near the end. Check the face to see that it is clean, and check the handle for splinters and inset in the head.

Place the face of the hammer on the nail, then strike it with a light blow to start the nail. The nail should be held by the thumb and fingers near the nail head.

Deliver the remaining blows by putting the shoulder, elbow, and wrist into the action and striking the nail squarely on the head to prevent bending it and marring the wood.

The last blow or two should be lighter than the power blows in the center of the operation. This may prevent or eliminate hammer marks at the nail head.

- b. Pulling Nails - The steps in pulling nails include:

Nails are pulled without damage to the hammer and the board by first slipping the claws under the nail head and raising the hammer handle until it is vertical.

Slip a block of wood under the head of the hammer while it is in the vertical position and continue pulling the nail unless there is too much strain on the handle.

It is better to pull a bent nail, caused by driving, and drive a new one in a new place.

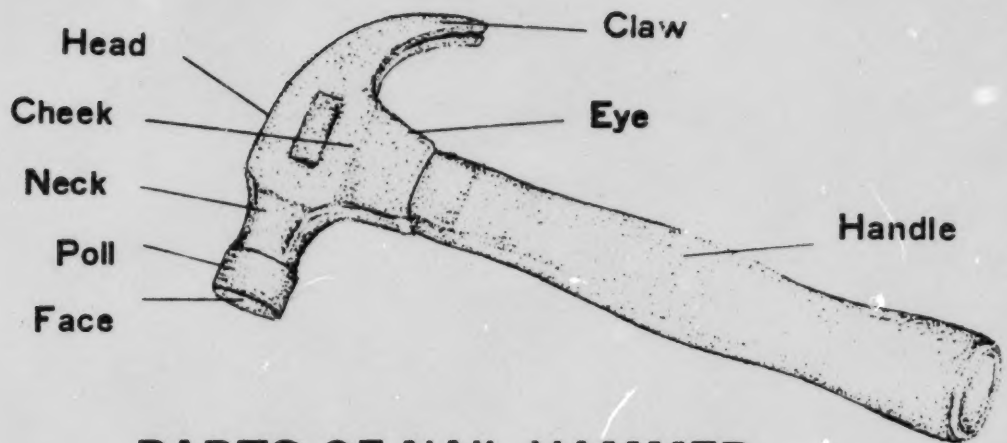
If pulling the nail requires putting too much pressure on the hammer handle, a wrecking bar should be used instead.

- c. Setting Nails - If casing, finish, or flooring nails are used it may be necessary to set the heads below the surface 1/16 of an inch by using a nail set. The set is braced by the lower fingers and tapped lightly with the hammer. Nail sets range in size from 1/32" to 4/32" at the tip or point.

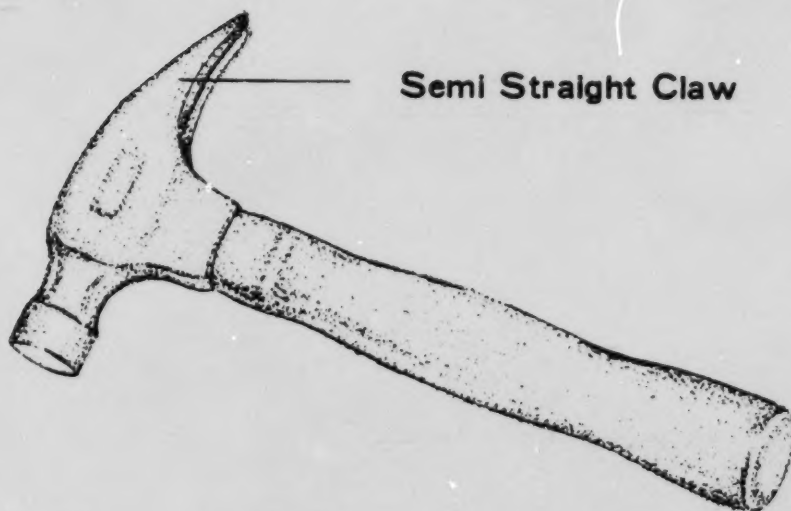
4. Use of the Wrecking Bar

- a. The most common ripping or wrecking bar is 24 inches in length. It has a gooseneck for pulling nails and a wedge-shaped, slightly bent end for prying loose boards. They can be found in size from one to three feet in length. Most wrecking bars are made of 3/4 inch octagon-shaped tempered steel.

SELECTING NAIL HAMMERS



PARTS OF NAIL HAMMER



Curved Claw

RIP HAMMER

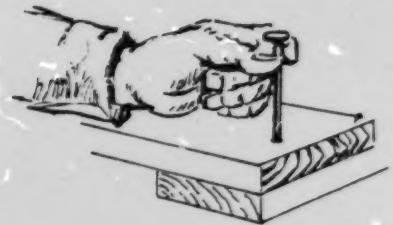


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USING NAIL HAMMERS



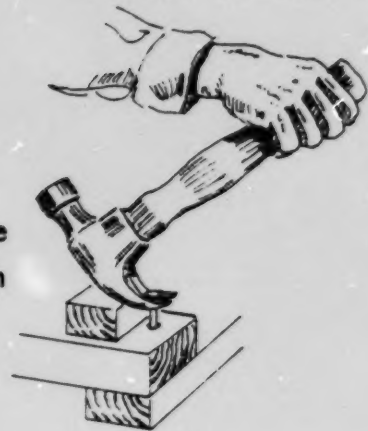
Grasp Handle Near End



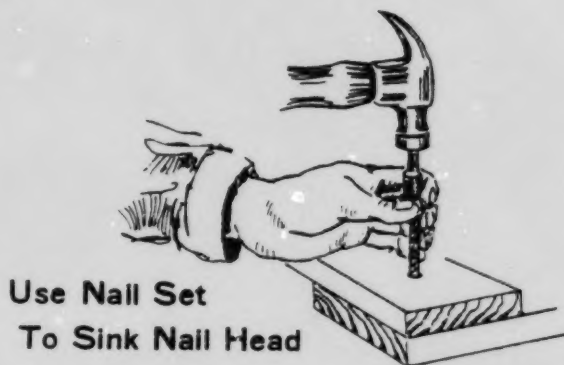
Use Finger And Thumb To Hold Nail



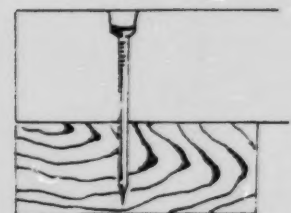
First - Raise Handle To Vertical Position



Finish Pulling Nail With Block



Use Nail Set To Sink Nail Head



**Nail Head Set
1/16 in. Below Surface**

- b. A wrecking bar is necessary for pulling large nails, wrecking buildings, opening wood crates, and dismantling many kinds of wood structures. A block of wood should be used under the goose-neck or the other end of the bar to protect the board from being marred. The wrecking bar is a protector of hammer handles, and it should be used if there is any doubt that too much strain is placed upon the handle. The wrecking bar is not a crow bar; therefore, it cannot be used to pry stones, timbers, or machinery.

B. Hand Planes

Suggested Procedure and Activities: The use of the hand plane as a teaching aid may supplement the use of transparencies.

1. The Importance of a Hand Plane

- a. The hand plane is considered useful as a paring or shaving tool for the following purposes:
 Planing of small and large pieces of boards to smooth the surface, either on the face, end, or edge.
 Planing to straighten and smooth surfaces for joining boards by gluing.
 Planing to correct the size or dimension of an object or piece of material. For example: doors can be fitted to the door frame by planing.
 Planing to eliminate twists or crowns (high parts in the face of a board).
- b. Hand planes are also used where jointers and planers are not available to smooth, cut a board to a certain size, or correct boards defects. Some of the first hand planes were made almost entirely of wood except for the cutting assembly. Wood hand planes are used for the same purpose as the modern planes are used today.

2. Selecting the Plane According to the Types of Job to Perform

Transparency No. 1

- a. Jack Plane - This plane is the most commonly used for the many types of hand planes. It is from 11-1/4 to 15 inches long and is used mainly to smooth the surface by cutting with the grain. It can be used for chamfering (cutting board corners to form a bevel), smoothing large surfaces, and straightening board edges. The most commonly used jack plane is 14 inches long with a 2 inch wide cutter blade.
- b. Smoothing Plane - A smoothing plane is from

5½ to 10 inches in length. It is used mainly for smoothing, surfacing, and finishing work. It can also be used to work end grain on boards. A plane with a 1-¾ inch wide blade, 8 inches long is considered standard.

- c. Block Plane - This plane is used for cutting end grain or working small pieces of materials. The average length of this plane is about 6 inches.
- d. The Fore and Jointer Planes - These planes are used for straightening the edges of long pieces of material or wood objects. The fore plane is 18 inches long, and the jointer plane is 22 to 24 inches long. Both the fore and jointer planes are also used for smoothing edges.
- e. Special Planes - The rabbet (for rabbeting edges), combination (for dadoing and grooving), and the circular plane (for planing concave or irregular surfaces) are of less importance to farm carpentry than the jack, smoothing, and block planes. Generally, special planes are used only for finishing type work. The duplex or full nose rabbet planes can be used to plane into the corners. The most commonly used rabbet plane is 8 inches long with a ½ inch blade.

Transparency No. 3

3. Assembling and Adjusting the Plane Before Using

a. Assembling the Jack, Smoothing, Fore, and Jointer Planes

The plane iron bevel (cutting edge) must be opposite the plane iron cap when the two are put together. It is placed on the cap so that the curved part of the cap will not be dragged over the plane iron edge.

The plane iron cutting edge should protrude from 1/32 to 1/16 inch beyond the plane iron cap, or about one-half the thickness of the plane iron.

The plane iron assembly should be placed on the plane frog so that the plane iron lies on the frog and the lateral adjusting lever.

The lever cap is placed against the plane iron cap, the lever cap screw is fitted in the narrow part of the screw slot, and the cam is pushed down against the plane iron cap.

Transparency No. 3

b. Adjusting the Plane

The plane is held upside down, and the protruding cutting edge (1/64 inch or a sheet

of paper thickness) is adjusted evenly across the plane bottom. The entire blade should be cut evenly.

The depth of cut should be made by turning the adjusting nut that is found in front of the handle. Plane iron setting (angle and depth) may also be made by placing two fingers on each side of the iron or protruding cutting edge.

- c. The block plane is assembled and adjusted in a smaller manner as the jack plane except there is no plane iron cap attachment.

Transparencies Nos. 4 and 5

4. Proper Use of the Hand Plane

a. Holding the Board or Stock

The board may be placed in a bench vise for edge planing, or a V-shaped block may be used to hold it securely.

A board may be held for face planing by nailing a stop block to the table or by clamping a stop block firmly to a work table.

The board should be held so that face and edge planing is accomplished by pushing the plane with the grain of the wood.

b. Making the Plane Stroke

One hand is placed on the handle and the other on the knob, and the plane is placed on the board at the back of the area to be cut before any pressure is applied in making the stroke.

At the beginning of the stroke, pressure is applied on the knob; near the middle of the stroke the pressure should be the same on both front and back of the plane; and at the end of the stroke the pressure should be on the handle of the plane.

The plane can be lifted slightly, the heel lifted slightly, or the plane tilted to prevent dragging the blade over the surface on the return stroke. When not in use, the plane should be laid on its side.

Strokes made by a block plane are short. It is used in one hand with the forefinger placed on the finger rest.

General practices in making the plane strokes include:

End grain should be planed half way from each side unless the corner at the ends and edges are beveled.

When straightening a board, high points should be removed before jointing the entire board. Cutting strokes should be made the full length of the board without removing the plane. A thin shaving should appear throughout the entire stroke.

Beveling or chamfering may be accomplished by making the strokes with the plane held at the desired angle or the board.

The quality of work is the same if the plane cut is straight forward or at a slight angle. Generally, the plane is pushed at an angle on the face of a board. The cut is usually made easier if the plane is held flat on the stock and pushed at a slight angle.

The block plane is the handiest of all hand planes for planing corners and bevels on small pieces of wood. It is especially useful for planing molding ends, trim, and siding. End grain should be planed with a block plane in the same manner as a jack or smoothing plane, with the end grain cut half way from each edge.

Transparency No. 5

5. Checking the Plane Cut

- a. A board should be checked for squareness while it is being planed. A block placed on the plane bottom near the knob and against the stock may help determine whether or not the board is square.
- b. The try or framing square should be used to check for high places on the surface that is being planed. If the board or wood stock is too long to check with a square, a straight edge should be used. The square is used to check a true plane surface.

TYPES OF HAND PLANES



JACK



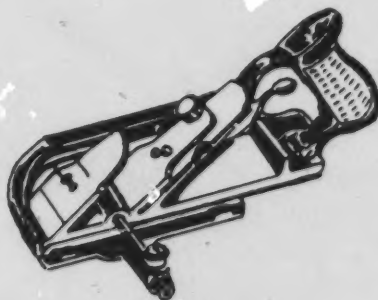
SMOOTH



BLOCK

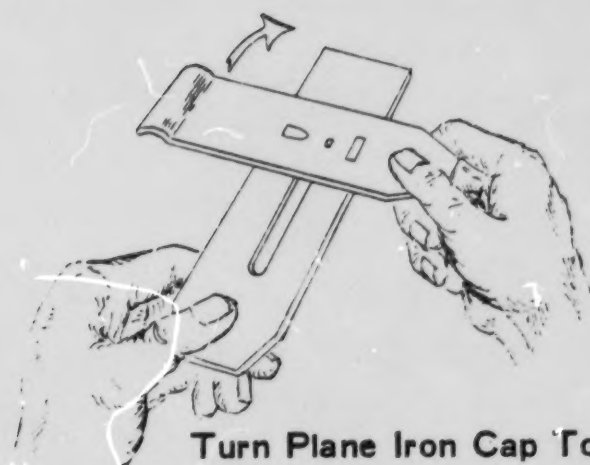


JOINTER



RABBET

ADJUSTING IRON AND PARTS OF PLANE

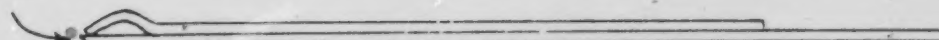


Turn Plane Iron Cap To The Right.
It Passes Back Of Cutting Edge

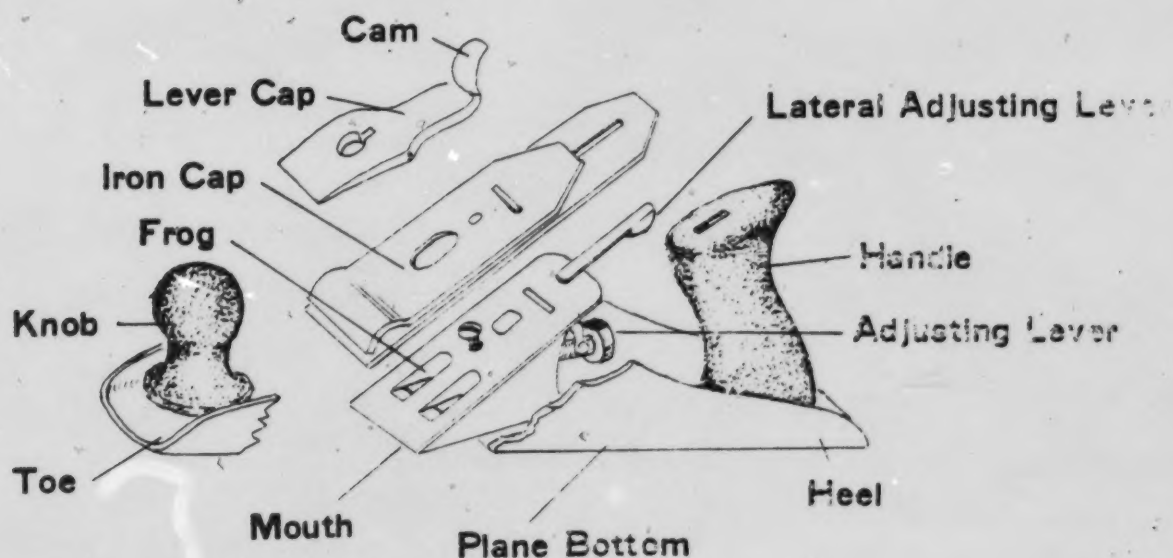


Slide Plane Iron Cap to Within
1/32in. to 1/64in. Of Blade Edge

Bevel



Cap Iron Screw



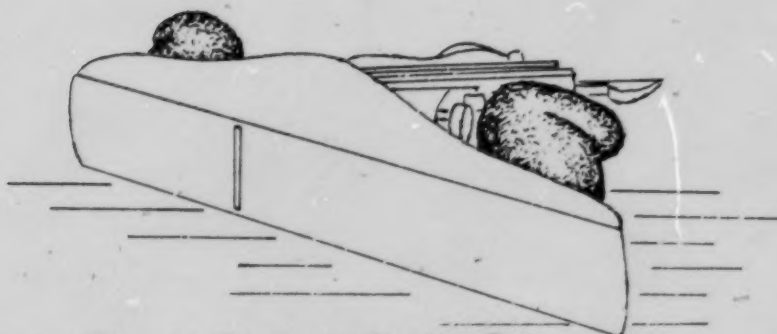
PLANE ADJUSTMENT AND CARE



To Make The Blade Cut Evenly Adjustment
May Be Made By Sighting Across It



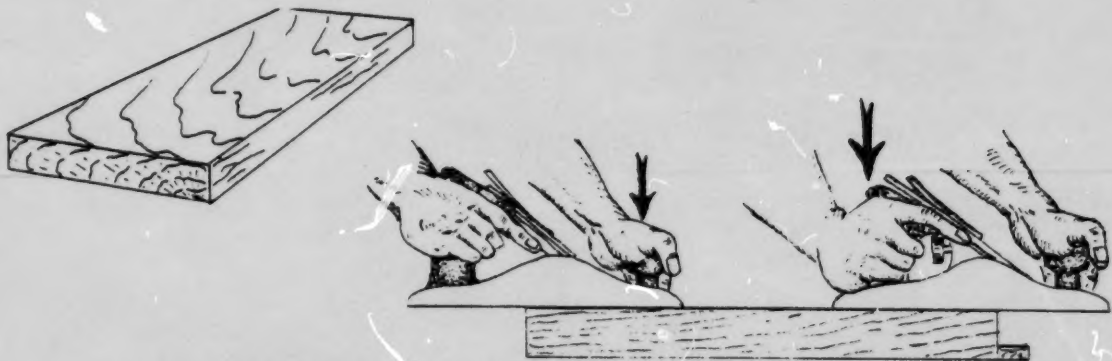
Blade Setting May Be Checked By The
Feel Of Two Fingers.



Plane Should Be Laid On Its Side
To Protect The Cutting Edge. 792

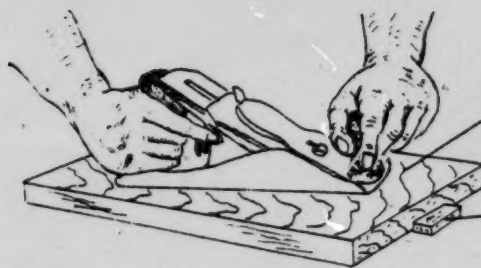
USE OF THE HAND PLANE

Board Or Wood Stock



Pressure Is On Knob At Start

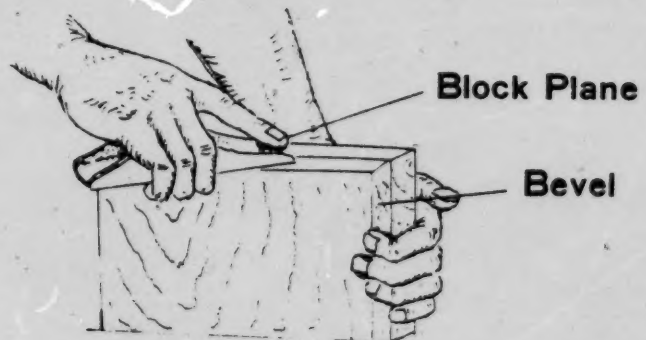
Pressure is On Handle At Finish



Plane With The Grain

Stop Block

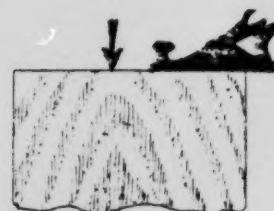
Pressure Is Equalized On Handle And Knob



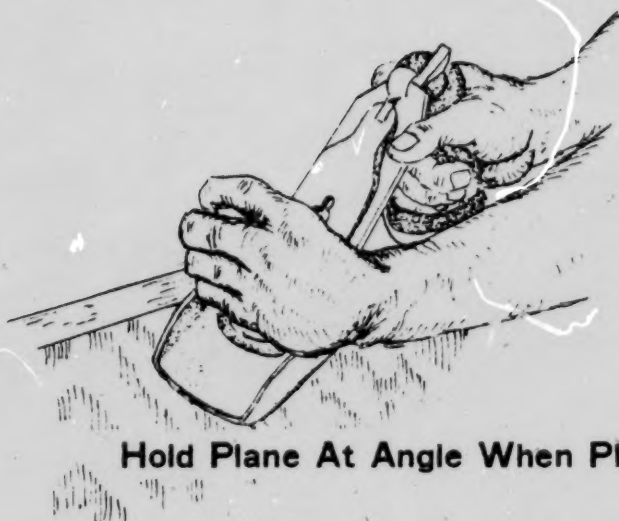
Block Plane

Bevel

USE OF THE HAND PLANE CHECKING PLANED WOOD STOCK

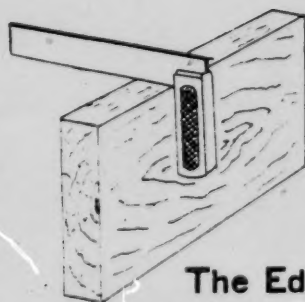


When Planing End Grain Plane To Center From Each Side.

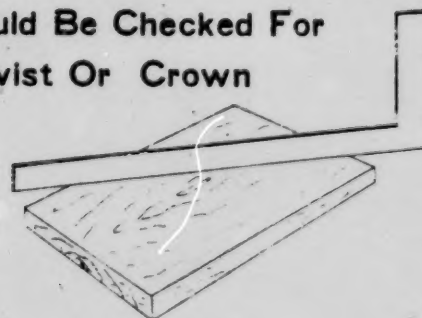


Hold Plane At Angle When Planing End

The Surface Or Face
Should Be Checked For
Twist Or Crown



The Edge And Face Is
Checked For Squareness
While Planing



C. Hand Saws

Identification, Use, and Conditioning of Hand Saws

1. The Importance of Hand Saws

Hand saws continue to be very important tools in a carpentry tool kit or in a well equipped workshop. Crosscut and rip saws are still used for straight sawing in certain types of woodwork construction projects. If there is a limited amount of cut-off and ripping work to be performed, the hand saw may be preferred over the power saw. Working in close places may require the use of a hand saw. It may be advisable to select the proper hand saw for cutting moldings, base boards, and facing materials instead of selecting a power saw for such work. Other reasons for using the hand saw are: power may not be available, work can be completed faster on some jobs, and work is easier when handling light tools in some locations.

2. Six Types of Hand Saws

- a. Crosscut Saw - The cross cut saw is the most commonly used of all hand saws for general farm work. Teeth on this saw are shaped to cut across the grain of wood. From perpendicular, the front of the tooth is 15 degrees and the back 45 degrees. The most commonly used crosscut saws have from 8 to 11 teeth per inch of blade. The length of the blade varies from 18 to 26 inches. The longest blade is the most popular. Fast and coarse cuts are made with a small number of teeth to 12 inch. Ten and 11 point saws are used to cut finishing materials such as moldings and door facings.
- b. Rip Saw - This saw is used to cut with the grain. The overall angle of rip saw teeth are the same as those of a crosscut saw, but the forward angle is only 8 degrees from perpendicular. Teeth cutting edges are square, and the back angles are 52 degrees. The most popular sizes are 24 to 26 inch blades with 5½ to 7 teeth per inch.
- c. Compass Saw - This saw is used to cut curves and circles, starting a cut from a hole bored by a brace and bit, and to cut holes for pipe outlets. The blades taper from back to front. Compass saw blades are 12 to 14 inches in length with 8 teeth to the inch. The shape of the teeth resembles those on a crosscut saw.
- d. Keyhole Saw - The keyhole saw is used to saw "cutouts". It may be found as a single blade saw or a nest of saws (one handle with two or three replacement blades). One of the blades

is used for cutting metal. This saw resembles the compass saw, but the standard blades range from 10 to 20 inches with 10 to 15 points per inch. Curves, holes, and straight sawing cuts are usually smoother when done with a keyhole saw than with a compass saw.

- e. Coping Saw - This saw is designed to cut thin or light wood. It is used to cut curves, for scroll work, and shaping the ends of moldings. Blades of this saw are about 1/8 inch wide and are made of thin metal. The overall length may vary from about 6 1/2 to 7 inches with 15 points to the inch.
- f. Backsaw - Backsaws are used to make accurate and smooth cuts. The large backsaw is known as a mitre box saw. They may range in length from about 22 to 30 inches. The width of the reinforced blade varies from 4 to 6 inches. Small backsaws are found in lengths from 10 to 16 inches, and the number of teeth per inch may vary from about 11 to 15. All backsaws and dovetail saws are reinforced the full length down the back edge of the blade.

Transparencies Nos. 1 and 2

3. Proper Use of the Different Types of Handsaws

a. Crosscut Saws

Assuming the material is on sawhorses or in a vise, grip the saw handle and place the index finger forward on the handle.

Place the free hand in a position on the material to be sawed so that the thumb can serve as a guide for starting the blade.

Hold the saw blade so that it is at a right angle to the stock and the saw cutting edge is 45 degrees to the surface being cut.

Start the saw cut by placing it on the waste side of the line and use draw strokes until a starting groove is formed. Maintain the 45 degree angle and take long even strokes as the saw cuts through the stock. If pressure is applied, it should be on the downward stroke.

b. Ripsaw

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Use the same procedure when sawing with a rip saw except for changing the angle to 60 degrees.

If the saw is pinched when ripping a long board, use a wedge to spread the pieces apart.

c. Compass and Keyhole Saws

After the stock has been marked, start the cut by either a light forward or backward motion.

Hold the saw in the proper position. For example, if the cut is to be square, the saw blade must be held perpendicular to the stock.

To cut a hole or cut an area out in a stock, first bore a hole and start the cut in the hole.

Cut curves and holes by slightly twisting the handle in the direction of the cut.

When sawing sharp curves and small holes, use the point or pointed part of the saw blade.

d. Coping Saw

Check the blade to determine whether or not the teeth are pointing toward the handle and the blade has proper tension. The blade is more likely to kink if the blade is inserted to cut on the forward stroke.

Hold the stock firmly in a vise, bracket, or saddle in order to make a smooth cut.

Turn the blade in the frame to keep the frame from touching the stock. Usually a quarter of a turn is adequate.

Make long, steady, slow strokes. Fast strokes tend to heat the blade and increase the possibility of kinks.

Release the tension on the blade when the saw is no longer used.

e. Backsaw

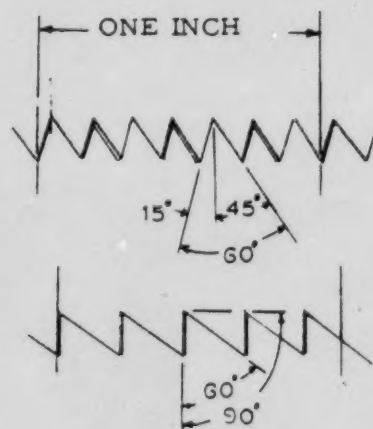
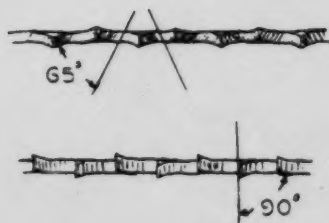
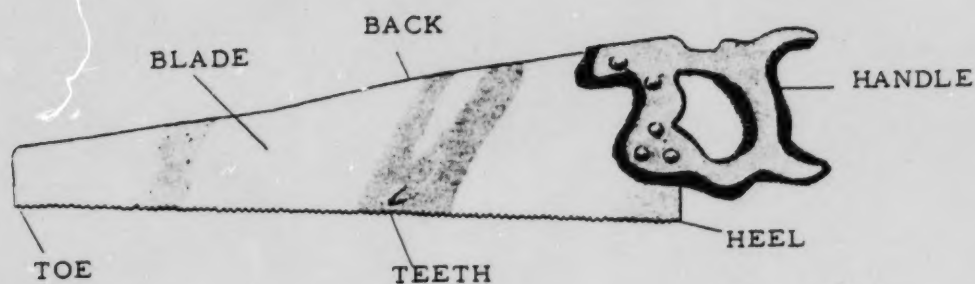
Start the backsaw cut in the same manner as a crosscut and rip saw cut; that is, pull the saw backwards to make the initial cut.

If the saw is used out of the mitre box, the thumb may be used to guide the blade on the line until the saw begins cutting the stock on the forward stroke.

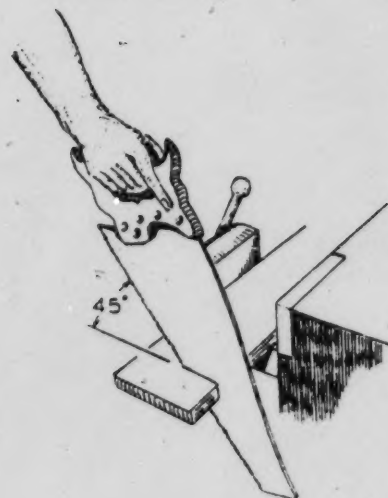
When using a mitre box to cut in either a 90 or 45 degree direction, place the stock in the box nearest the body and use the free hand to hold the stock. The thumb of the free hand is not used to guide the blade, but the index finger is placed along the side of the handle.

Make long even cuts by holding the blade level on the stock, and use an even pull and push motion.

HAND SAWS



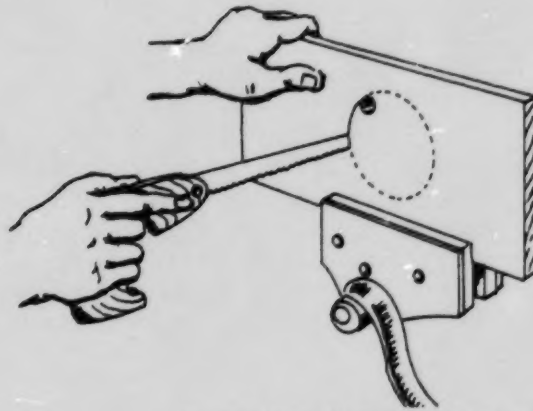
Rip saw



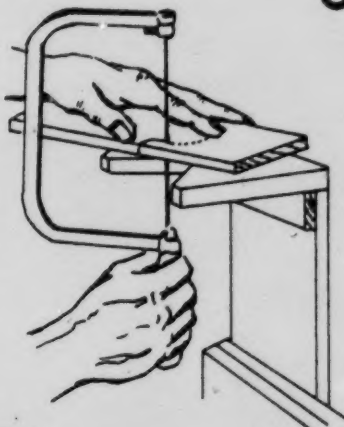
Crosscut saw

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HAND SAWS



COMPASS SAW



COPING SAW



BACK SAW

D. Wood Chisels

Suggested Procedure and Activities: Exhibits of joints shaped by the chisel and the types of chisels and mallets may be helpful during the discussion.

1. Selection of Wood Chisels and Mallets

- a. Wood chisels are selected according to the type of work that is to be performed. Naturally, a $\frac{3}{4}$ inch dado work will require a chisel larger than $\frac{1}{2}$ inch and smaller than $\frac{7}{8}$ inches. A $\frac{1}{2}$ to $\frac{5}{8}$ inch chisel will permit working room for notching out and smoothing the $\frac{3}{4}$ inch dado surface.
- b. Wood chisel sizes vary from $\frac{1}{8}$ to 2 inches. The length of blade ranges from about 3 to 6 inches. Long lengths are called firmer chisels. Medium lengths are called pocket chisels. Short lengths are called butt chisels.

Transparency No. 1

- c. Wood chisels are also classified according to the type of handle attachment.

Socket Chisels - This is the most common type of chisel used in farm carpentry. Due to the handle being fitted into a steel socket, the chisel can withstand harder blows from the mallet. These chisels are used for rough woodwork and framing. The most common sizes are $\frac{3}{8}$, $\frac{3}{4}$, and 1- $\frac{1}{2}$ inch.

Tang Chisel - The handle of a tang chisel is similar to that of the socket chisel except that the tang is fitted into the handle. Less driving pressure should be applied to the tang chisel than to the socket chisel. Tang chisels are better for hand work, such as paring, because of their light weight and balance. The tang of a chisel is the spike-like or file-like handle part of the chisel fitted into the handle. This type of chisel usually has a plastic handle.

Transparency No. 22. Steps in Making a Cut with the Wood Chisel

- a. The board of work should be fastened firmly. A vise is the best method to use for short wood stock.
- b. The chisel cut should be made with the grain to prevent the board from splintering or splitting.
- c. One hand should be used to guide the chisel blade, and the other hand should be moved

slightly from right to left as pressure is applied to the chisel handle.

- d. The bevel should face down when making rough cuts, and it should be face up when paring or finishing materials.
- e. The first cut over a surface may require the use of a mallet, whereas the finishing cut of the same work should be done by hand. This method of chisel cutting is used mainly for making joints.

3. The Different Uses of the Wood Chisel

Transparencies Nos. 3 and 4

a. Dado Trimming

Wide dados should be cut several times with the saw and the large portion of the material removed by the mallet and chisel.

Trimming should be half way from each edge of the cut and at the same time in a upward direction. The center should be trimmed last.

b. Notch Edge Trimming

After the notch is marked out accurately several cuts should be made with the saw.

The larger portions should be removed with the chisel and mallet.

Trimming or smoothing should be made in the same way as the dado cut.

c. Curve Trimming

An outside or convex curve can be finished with a wood chisel after about three straight cuts are made along the curve line.

The chisel bevel should be up while trimming around the curve.

Inside curves should be trimmed with the bevel down. Most inside curves are usually first cut with a sabre or keyhole saw.

d. Paring Chamfers or Cutting a Bevel

Chisels are used similarly to a plane to make a slight bevel on a board. The bevel side is up when making a cut.

To prevent splitting, the bevel should be made with the grain first, then followed by working the chisel at an angle along the end grain.

e. Mortise-and-Tenon Joint

The area marked off for a mortise according to the size of tenon to be used (mortise is a hole cut into a board, and a tenon is the cut that is inserted into the mortise).

A brace and bit can be used to cut out the tenon area, leaving shaping-up for the chisel, or the chisel can be used to make the entire cut.

The rough work is made with the mallet whether or not a brace and bit are used, and the trimming or finishing is done by hand, without the use of the mallet.

f. Trimming End Grain of a Dado

The flat surface of the chisel should be on the end grain at an angle and the handle brought upward as the cut is made.

The flat side of the chisel should leave a cut equal to the original end grain cut.

g. Rabbet Trimming

Rabbeting requires the use of several saw cuts if the second piece of board is large. (A rabbet is a groove cut into the edge or end of a board to receive another board.)

Chiseling may be used for finishing. Chiseling a rabbet joint is similar to chiseling a dado; the flat side is held against the board surface.

h. Installing Butt Hinges with a Chisel and Mallet

The area is marked off according to the hinge size.

The wood is chiseled out by leaning the chisel slightly toward the flat side and tapping it with the mallet.

The area is trimmed out without the use of the mallet by working the chisel with the flat surface against the cut.

4. The Common Wood Joints that may be Trimmed by Use of the Wood Chisel

Dado	Middle lap
Mortise-and-Tenon	End lap
Rabbet	Mitre
Cross lap	Half lap

5. Care of the Chisel While in Use

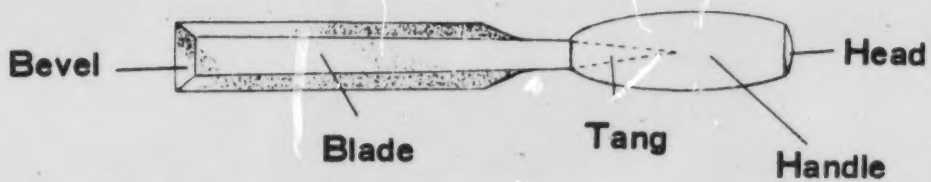
The chisel should be laid on a table with the bevel down to protect the cutting edge.

The wood chisel should be kept sharp and the cutting edge protected from all metal.

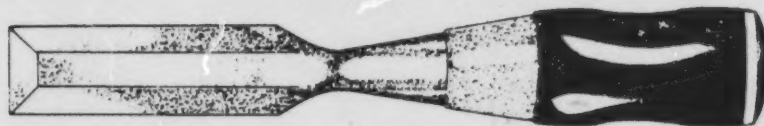
A chisel, like all other tools, has a certain purpose and should be used for that purpose. It must not be used to pry open containers, used as a screwdriver, and the hammer should never replace the mallet to drive the chisel.

PARTS AND TYPES OF WOOD CHISELS

Parts of a Wood Chisel



A Socket Chisel With A Wood Handle

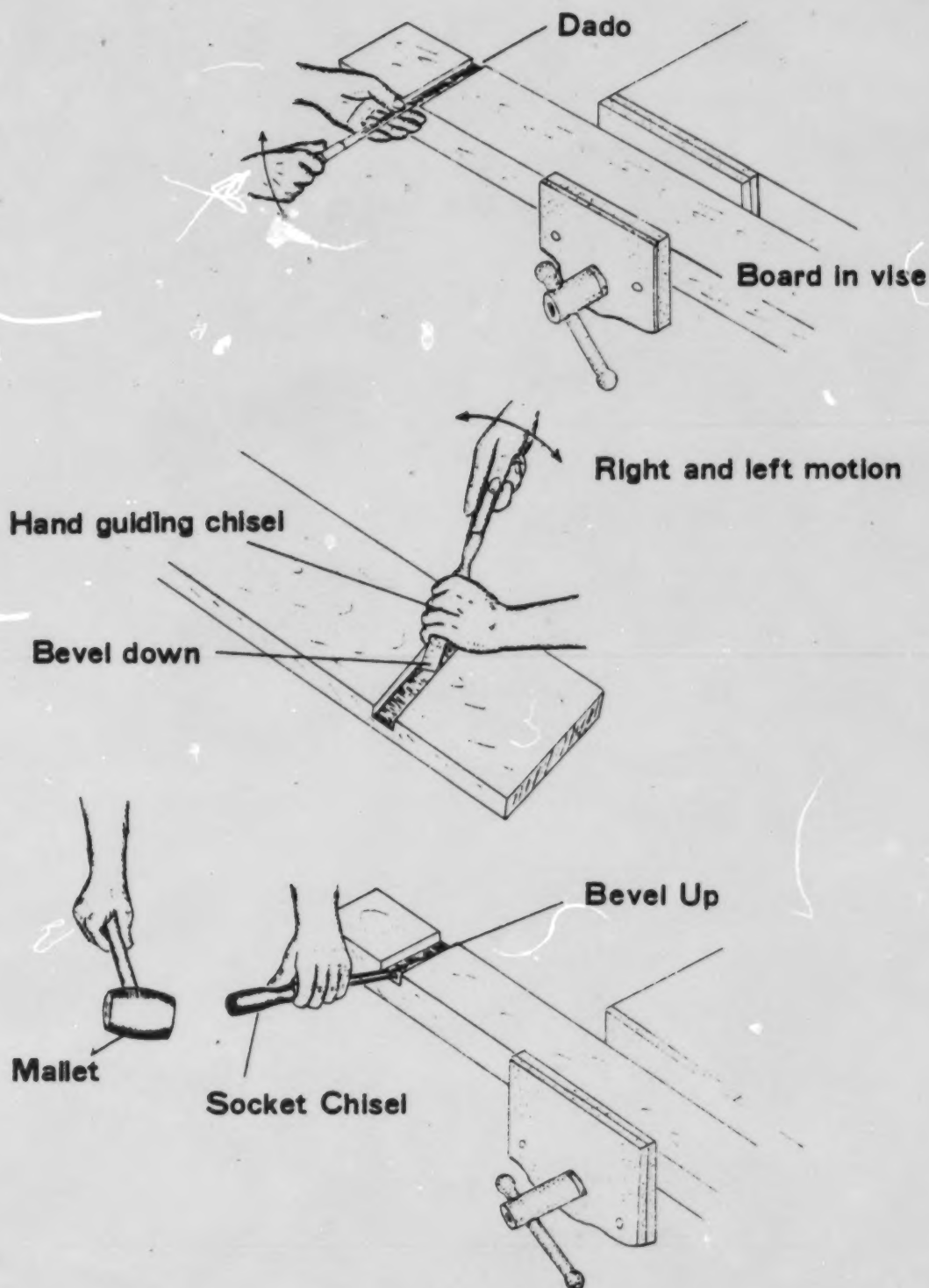


A Socket Chisel with a plastic handle

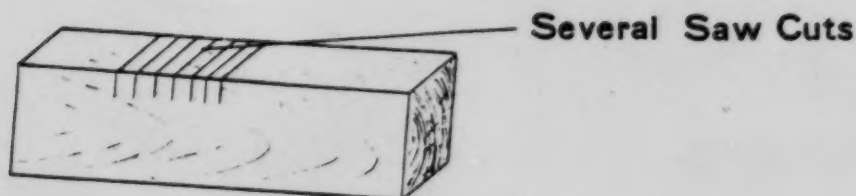


A Tang Wood Chisel

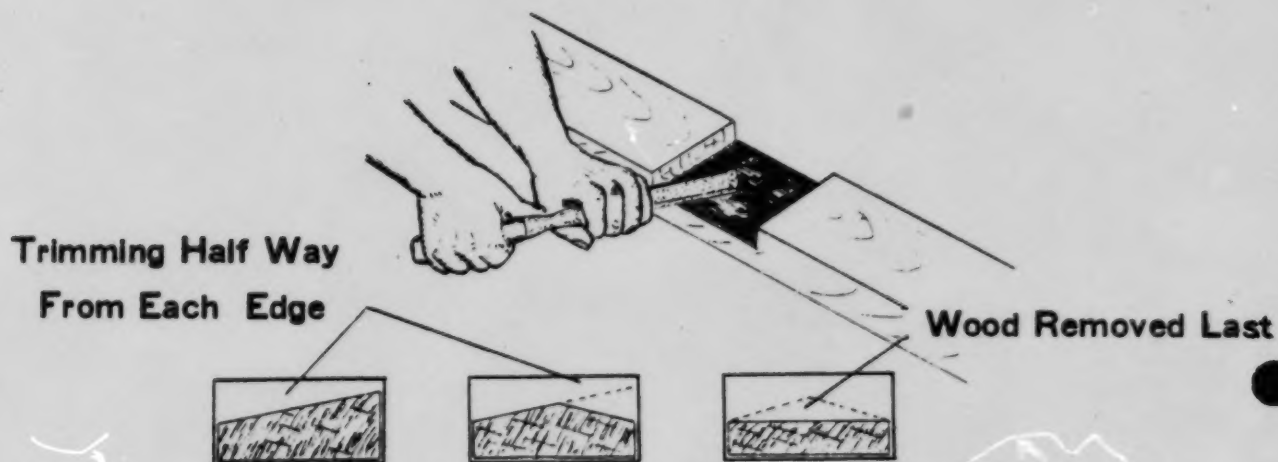
STEPS IN CUTTING WITH A CHISEL



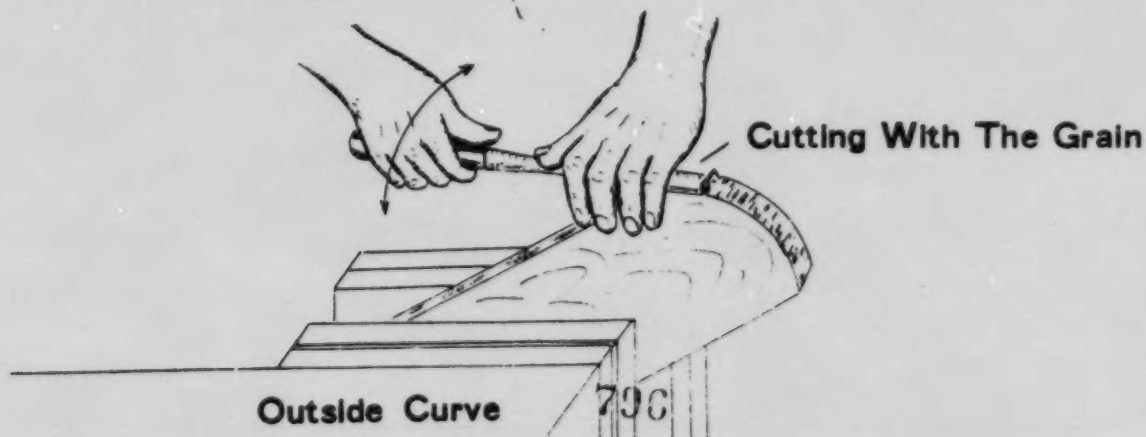
DADO , NOTCHING AND CURVE CUTTING



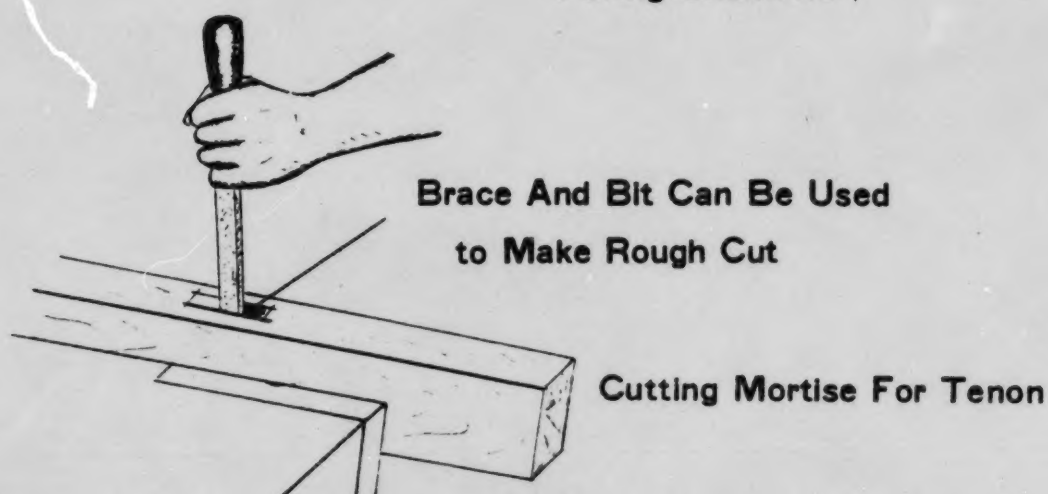
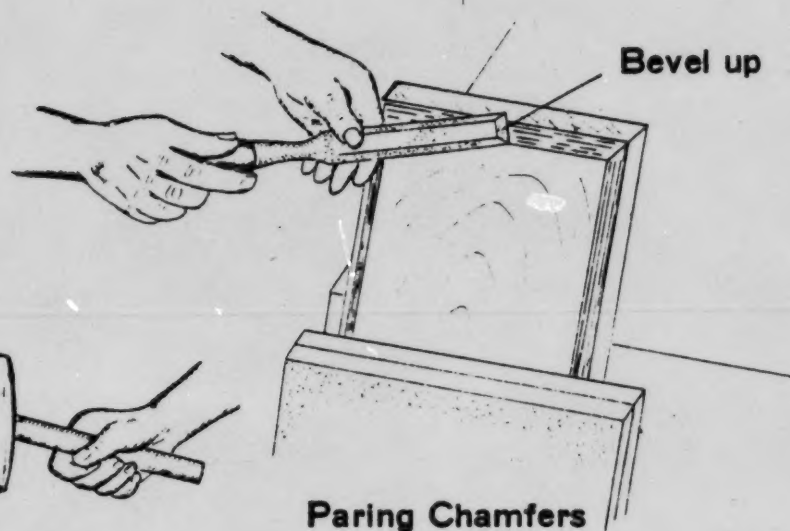
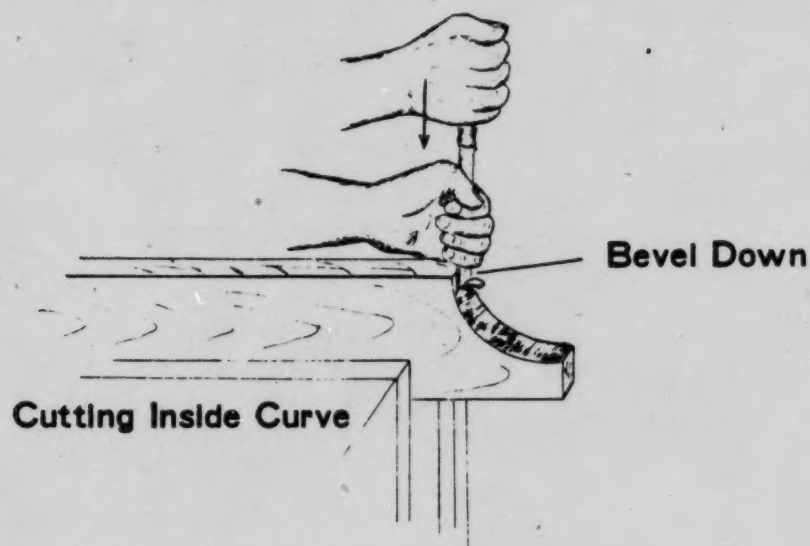
Edge And Dado Cut



Trimming Dado



INSIDE CURVE, PARING AND MORTISE-AND-TENON



E. Brace and Bits

Suggested Procedure and Activities: Except for the transparency on the parts of a brace and bit, a demonstration of the use of a brace with the different types of bits may be the best teaching aid.

Transparency No.1

1. Selecting the Brace

The two-jaw chuck brace is equipped to handle the seven major types of bits discussed in this lesson. The chuck clamps the square shank bit by the bit tang to hold it firmly in place.

Braces range in size from about 6 to 14 inches. The size is determined by the brace swing or sweep, that is, the distance across the diameter of the circle made by a complete sweep of the handle. A 10 inch sweep brace is most commonly used to do average work.

The ordinary brace without the ratchet may cost less than the ratchet brace, but its functions are limited. The ratchet permits the boring of holes in places where a full handle turn cannot be made due to obstructing objects. The ratchet works both ways, forcing the bit forward or backward. It can also be set so that the handle will not swing free in the operation.

Corner braces are equipped with two handles and a head. It is used for boring against walls and in corners.

Transparency No. 2

2. Selecting the More Common Types of Bits

The auger bit is used for boring holes in wood. The tang on the shank is usually square, depending on the type of brace used. Auger bits range in size from 3/16 inch to about 2 inches. A No. 11 bit will bore a hole 11/16 inch in diameter. The figure 11 is found on the shank. Auger bits are usually found in sizes from 1/4 inch up to 1 inch, graduated in one-eighths of an inch.

The expansive bit is used to bore holes ranging from 1 to 3 inches in diameter. The blade or cutter may be adjusted for different sizes of holes. The expansive bit is similar to the auger but in that it has a feed screw that draws the bit into the wood. It has only one lip; therefore, it must be held straight.

The forstner bit is also used on wood. It can be used to bore holes for dowel pins and counter-sinking washers that are used with bolts on wood. The sizes range from 1/4 inch to 2 inches in diameter.

The twist drill bit, which is sharpened with the same angle as the round shank bit for metal, is used for both metal and wood boring. The more pointed bit stock or twist drill is used for wood only. The sizes may range from 1/16 inch to 1-1/4 inches in diameter.

Screwdriver bits are used to set or loosen screws or bolts with slotted heads. The size is determined by the width of the bit blade. The widths range from 3/16 inch to over 1/2 inch.

Countersinks are used to widen the space at the hole entrance for oval or flat head bolts or screws. The head of the screw or bolt is set flush or slightly below the surface. The size is determined by the diameter of the cut made by the largest part of the bit.

Gimlet bits are used to make holes for screws in wood. The bit point forms the tapered hole. They vary in size from 1/8 inch to 3/8 inch in thirty-seconds.

A lock set bit is used to make holes for cylindrical locks. This type of bit is usually used with a lock jig.

Transparency No. 3

3. Placing the Bit in the Brace and Setting the Ratchet

Grasp the check shell and brace handle; holding the chuck in an upward position, turn the handle to the left until the chuck jaws are open.

Place the bit in the jaws of the chuck and turn the handle to the right.

Check the bit as the jaws of the chuck are tightened on the tang. The bit must be held firmly between the jaws while it is in use.

When boring a hole in a corner, or some obstruction prevents the full turn of the brace handle, the ratchet should be adjusted as follows:

With the bit pointed in an upward position, the cam ring should be turned to the right to permit the bit to turn to the right for boring a hole.

If the cam ring is turned to the left the ratchet action will be to the right, and the bit can be withdrawn from the wood.

Transparency No. 3

4. How to Start the Hole by Using the Brace and Bit

Steps in starting the auger bit include:

- a. Mark the location of the hole center by crossed lines.
- b. Start the hole with a sharp pointed tool (awl or ice pick).

- c. Grasp the lower part of the bit (twist) and place the hand against the board; at the same time insert the point of the bit into the hole at an angle.
- d. Raise the bit until it is at a right angle with the work.
- e. Test to see that the hole is being bored squarely by:

Sighting the bit at right angles.

Comparing the bit with the nearest straight edge. The sides of the bench vise that holds the material may be used as a straight edge.

Use a try-square near the bit.

Transparency No. 4

5. Boring the Hole

a. Applying Pressure on the Brace

Pressure is applied by one hand when boring a vertical hole. Usually, the left hand is used to put pressure on the head of the brace.

When boring a horizontal hole, the left hand is placed over the brace head, and the thumb and forefinger are placed around the quill. The stomach puts pressure against the left hand.

b. How to Prevent Splintering, Splitting, and Making a Counterbore

When boring a hole through a board, splintering can be prevented on the second face by stopping when the screw point is felt. The auger bit point should be entered in the point hole on the second face to complete the hole.

It is best to clamp a board to the second face piece of material when using an expansive bit.

Splitting is prevented when drilling large holes in thin or narrow pieces of wood by either placing the piece in a vise so that the jaws protect the edges or by first boring the hole with a small twist drill and then drilling with a larger twist drill.

When countersinking for bolt or screw heads, the hole should be made before the counter-boring.

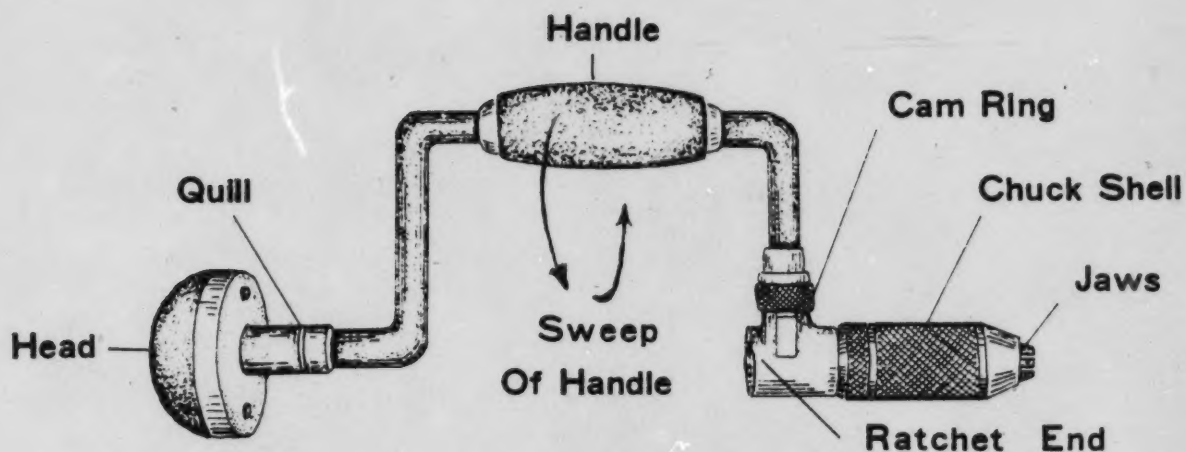
Transparency No. 46. Determining the Proper Depth When Boring a Hole

Methods to use when boring holes to a certain depth are:

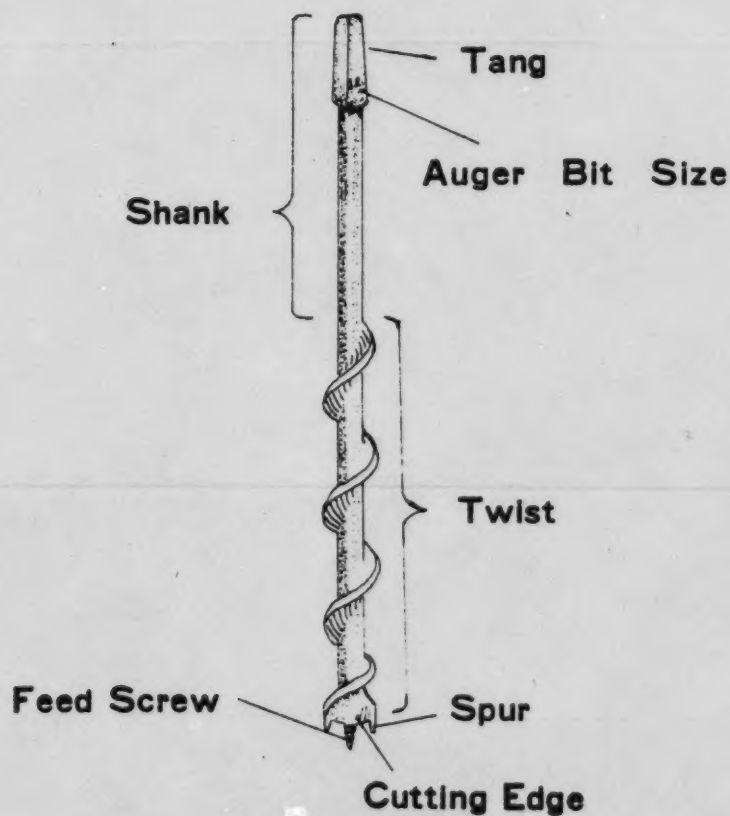
- a. Wooden Stop - A small block of wood center bored, with the bit projecting from the block to the desired depth of the hole is most satisfactory.
- b. Metal Bit Stop - This type of bit stop is attached to the bit by a wing nut. It can be moved up and down the bit twist.

After the cutting lips touch the wood, a rule will show the distance from the wood surface to the chuck. Measurements can be made as the hole is being drilled. If several holes of the same depth are to be made, it is best to use a block cut to fit under the chuck.

PARTS OF THE BRACE



PARTS OF THE AUGER BIT



TYPES OF BITS



Auger



Expansive



Forstner



Twist



Screw Driver



Countersink

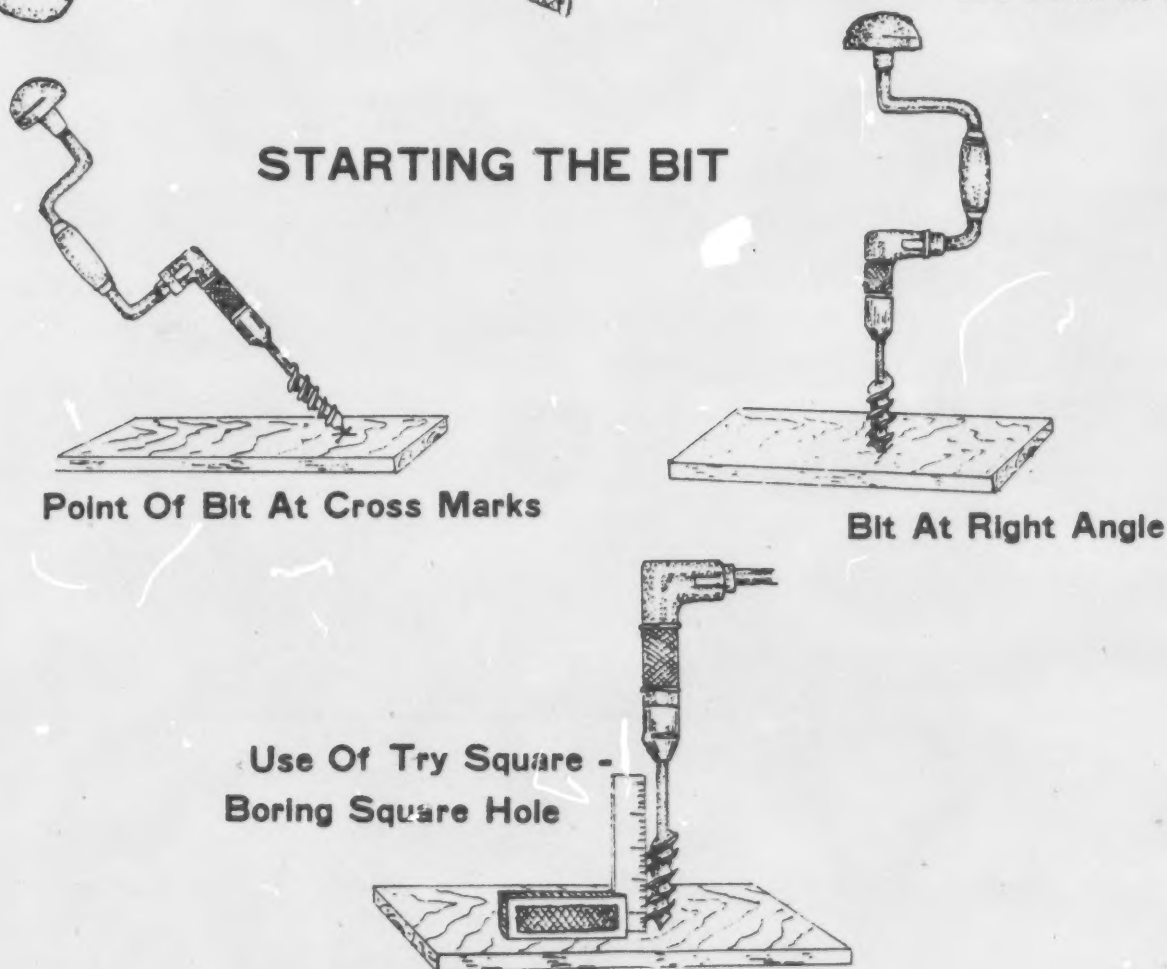


Gimlet

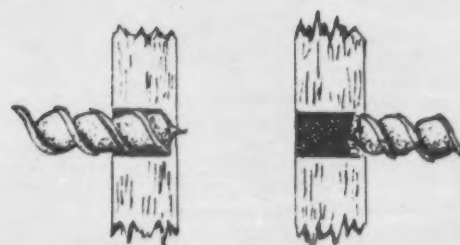
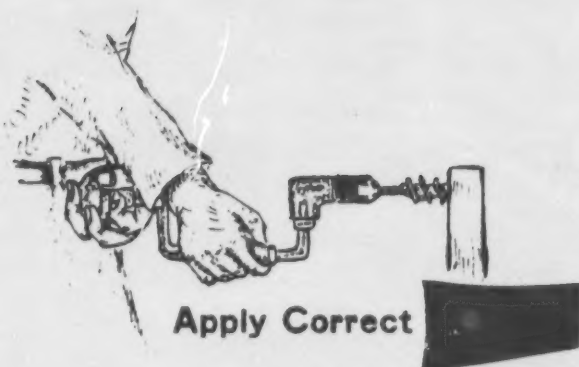
PLACING THE BIT IN THE BRACE



STARTING THE BIT

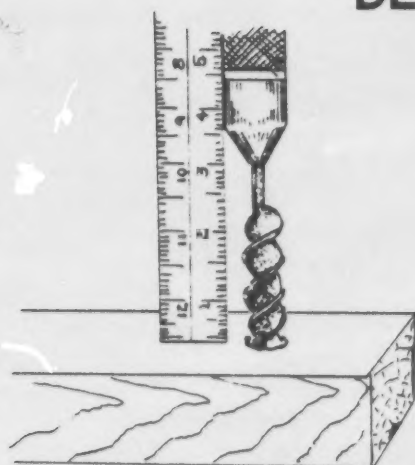


BORING A HOLE THROUGH A BOARD

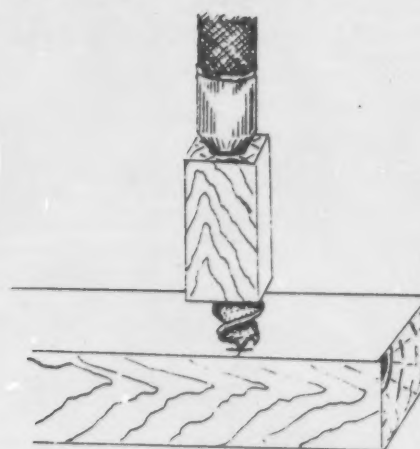


Reversing Bit To Prevent Splintering

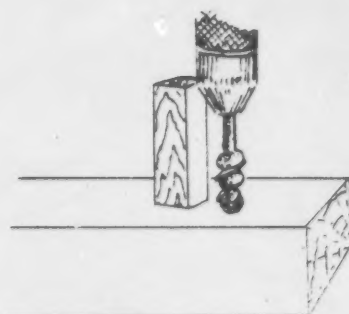
DETERMINING DESIRED DEPTH



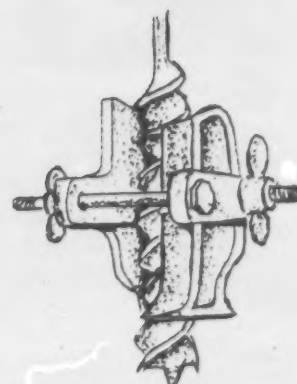
Use Of Rule For Proper Depth



Use Of Block For Depth



Outside Block For Depth



Use Of Depth Gauge

F. Hand Drills

Suggested Procedures and Activities: The types of hand drills and drill bits from the agricultural mechanics shop may be used as teaching aids during the discussion.

Transparency No. 1

1. Types of Drills Operated by Hand and Their Purposes

a. The three major types are:

Hand drills
Breast drills
Push drills
Hand operated drill press (not a major type)

b. Hand drill purposes include:

Drilling small holes, either in wood or metal, $\frac{1}{4}$ inch or less in diameter.

Form holes or openings for screws, nails, bolts, and other materials where openings are necessary.

c. Push drills are used mainly to bore holes for small screws in wood and other soft materials. A push drill is made to bore a hole less than $\frac{1}{4}$ inch in size. Most push drills have a set of bits ranging from $\frac{1}{16}$ to $\frac{11}{16}$ in size stored in the handle. This drill may be operated by one hand while the other hand is left free to support the work.

d. Breast drills are designed for heavier work than either hand or push drills. They are usually constructed with adjustable handles and two speeds. The drill is made to bore a hole up to $\frac{1}{4}$ inch. The breast drill is for general purpose work in metal and wood.

e. The hand powered drill press was one of the oldest types of heavy duty drills. A large wheel was turned with one hand as the other hand pressed the drill into the stock being drilled by using a lever. In some cases the hand operated drill press exceeded $\frac{1}{4}$ inch capacity. Holes in both metal and wood could be bored with the hand operated drill press.

2. General Characteristics of the Drill Press

- a. Chuck (has three jaws) holds the bit in place.
- b. Pinion is the small gear attached to the main frame which is turned by the speed gear.
- c. Crank handle is attached to the speed gear on hand and breast drills.
- d. Handle is the top part of the main frame held by the hand when operating the drill.
- e. Speed gear turns the pinion gear and pinion

idler on the hand drill. A breast drill may have only the pinion gear.

- f. Frame supports gears, handles, and chuck.
- g. Side handle is located opposite the speed gear on a hand drill and above the chuck on a breast drill.
- h. The push drill is made up of a check, chuck sleeve, spiral spindle, locking ring, and handle.
- i. The breast drill has a breast support or plate, whereas the other two drills have handles. Most hand drills and push drills have magazine handles (they hold bits).

Transparency No. 2

3. Inserting and Removing the Bit

- a. Hand drill bits are inserted in the following manner:

Hold the chuck and turn the crank backward to open the jaws slightly larger than the bit diameter.

Center the bit and tighten the chuck by holding it firmly and turning the crank forward.

The bit is removed by holding the chuck and turning the crank backward.
- b. The procedure to insert and remove the bit from the breast drill is the same as that of the hand drill.
- c. The push drill chuck sleeve is pushed forward to insert the bit. It is also pushed forward to release the bit.

Transparency No. 3

4. The Proper Way to Use a Drill

- a. The hand drill should be held firm and steady while in use, regardless of the angle it is used on the work.
- b. The handle of the hand drill may be held against the body, releasing the hands for the crank and side handles. This is the way a breast drill is used.
- c. An even pressure should be exerted on the handle or handles. The crank should be turned at a steady speed and not too fast.
- d. The push drill is used with one hand placed on top of the handle. The return spring causes the drill to unwind on the backward stroke, which helps clean the hole and forces the bit into a cutting position.

- e. The steps to follow when drilling a hole are:

The center of the hole should be marked with an awl or similar tool for drilling soft material and with a center punch for metals.

Select a drill bit of the proper size (the diameter of the cutting part may be slightly smaller than the large part of the screw of bolt for soft materials, and it should be the same size for metal materials.)

The stock being drilled should be held firmly, either in a vise or by other means.

On metal, a drop or two of oil should be used at the place of drilling.

The pressure should be eased as the drill breaks through the surface.

A small pilot hole made by a small bit is necessary in forcing a larger bit through certain woods or metals.

To drill to a certain depth, a depth gauge may be made from a piece of wood. The piece of wood is drilled and slipped over the bit.

To clean a drilled hole, the bit should be turned in the drilling position as it is withdrawn from the stock. The bit should be removed frequently during the drilling process to clean the hole.

5. Drill Bits with Round Shanks

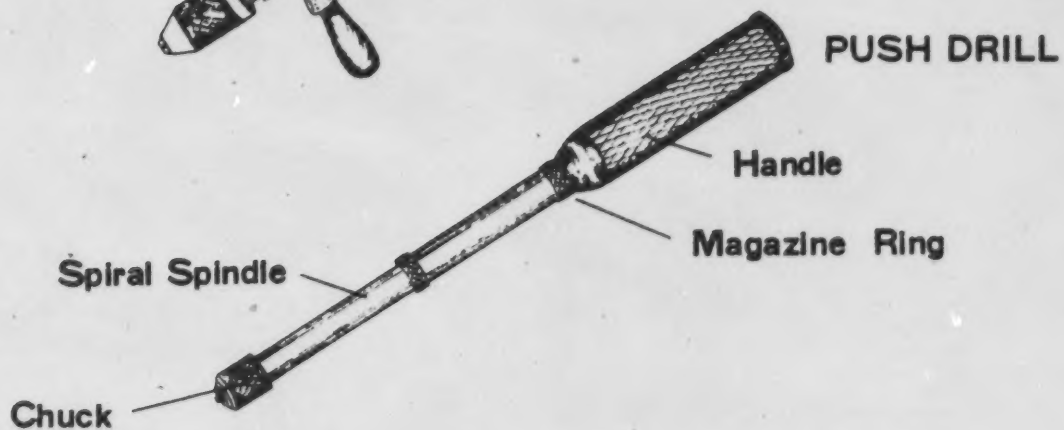
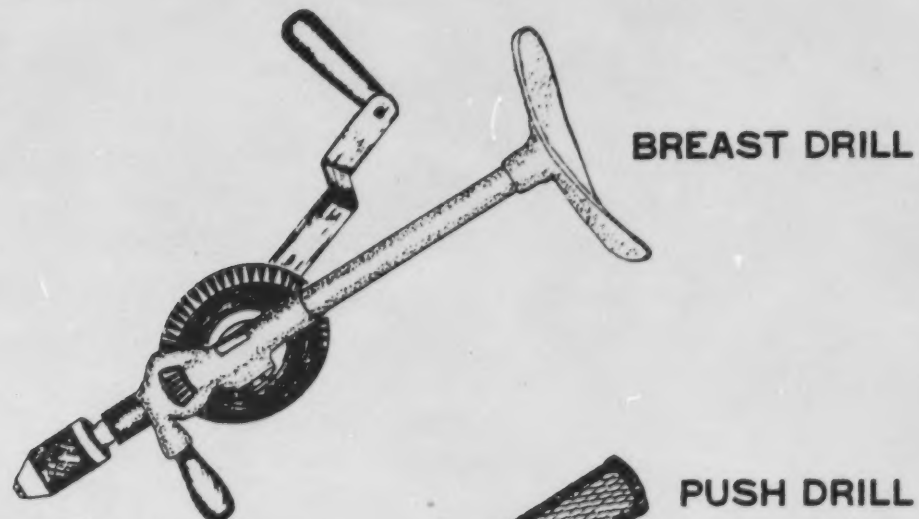
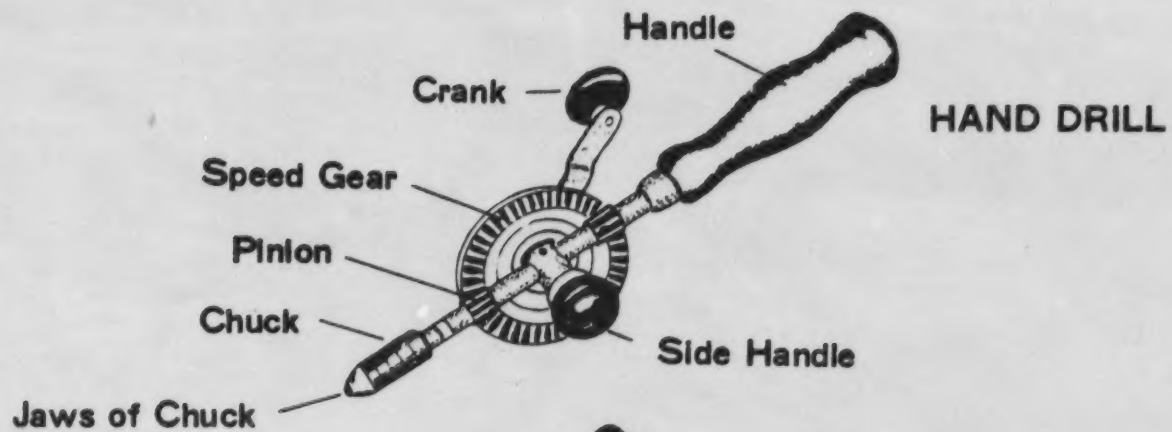
- a. Types of drill bits are:

Drill points for push drills range in size from about 1/16 to 11/64 inch.

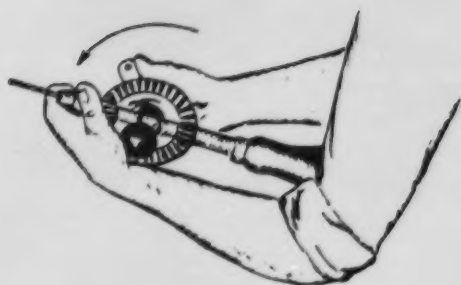
Twist drills are used for metal and wood drilling. They are found in sizes measured by 1/64 inch units.

- b. Usually hand drilled holes are less than $\frac{1}{4}$ inch in diameter, and breast drilled holes rarely exceed $\frac{1}{2}$ inch in diameter.

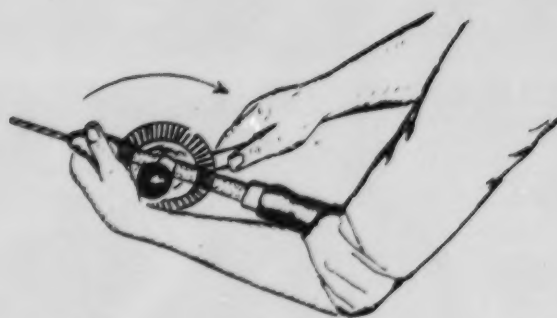
TYPES OF DRILLS AND PARTS



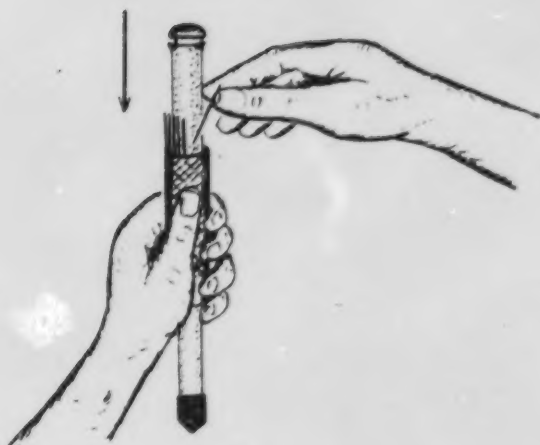
INSERTING AND REMOVING DRILL BITS



Inserting Bit



Removing Bit

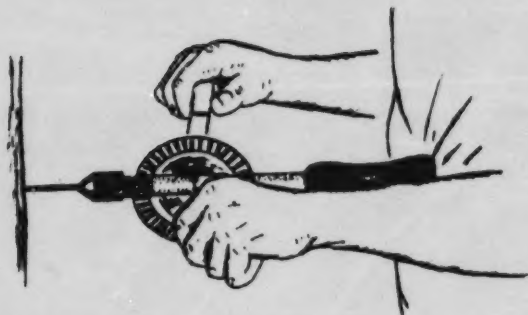


Removing Bit From Magazine



Inserting or Removing Bit

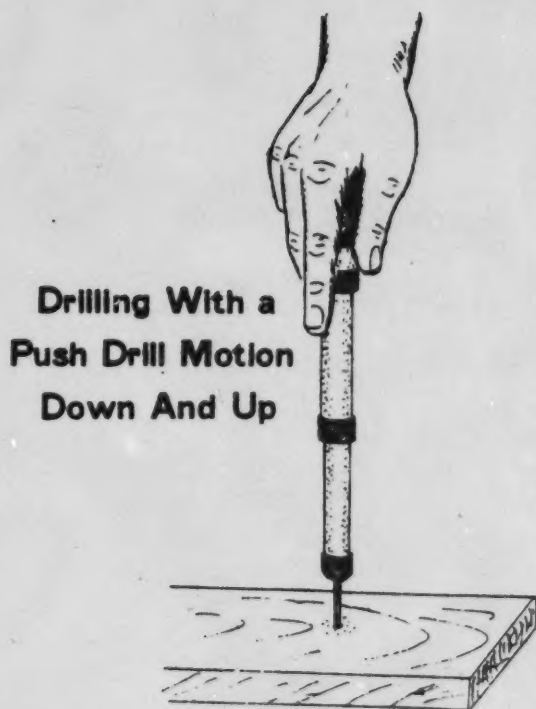
USE OF HAND DRILLS



Pressure of Body Used on Hand Drill



Drill Stock And
Drill Held Firmly



Drilling With a
Push Drill Motion
Down And Up



Piece of Wood Used
to Gauge Depth of Bit

G. Screwdrivers

Suggested Procedures and Activities: An exhibit of screwdrivers, screws, and pilot holes may be used during the discussion.

1. Selecting ScrewdriversTransparency No. 1

- a. The types of screwdrivers and their major parts are:

Standard or common	Spiral-ratchet
Phillips	Screwdriver bit
Offset	

The standard screwdriver has five major parts.

Head	Blade
Handle	Tip
Ferrule	

The spiral-ratchet parts:

Handle	Chuck
Ratchet	Bits
Spiral	

Transparency No. 2

- b. Standard screwdrivers are usually from 1- $\frac{1}{4}$ inch to 18 inches in length. The handles are either made of plastic or wood with a blade that extends through the entire length of the handle. Screwdriver bits for braces are about 5 inches long and their tips are $\frac{1}{4}$ to $\frac{1}{2}$ inch wide. Spiral ratchet screwdrivers are available with several different types of blades.

A screwdriver should be selected according to the type of work to be performed.

A long-bladed screwdriver is easier to use than one with a short blade if enough space is available to work with it.

The standard screwdriver tip should be square and no wider than the screw head. The tip should fill the screw slot. The Phillips tip must fit the screw slot.

- c. Results encountered when selecting an improper screwdriver for the job are:

The tip will scar the wood around the head of the screw if it is too wide.

If the tip is curved it will mar both the screw and wood. The screwdriver cannot

be kept in the screw slot if the handle is not kept in line.

A small tip should never be used on a large screw; the screwdriver tip, screw slot, and the material may be damaged.

A tip that is too large for the screw slot will damage the screw and the surface of the material if it is forced into the screw slot.

Transparency No. 3

2. Using the Different Types of Screwdrivers

- a. Standard Screwdrivers - The hand is placed in the palm of one hand and the blade is guided with the other hand by holding it near the tip. The blade is kept parallel with the screw or bolt as it rotates. The hand near the tip keeps the tip square on the head as a new grip is placed on the head or handle.
- b. Spiral-Ratchet Screwdrivers - This screwdriver can be used in awkward places for driving or drawing screws. One hand is placed on the handle without releasing the grip. The other hand is placed on the chuck. The handle is pushed straight.
- c. Screwdriver Bit - This bit may have a tapered or round shank. If it is used with a ratchet brace, a quarter of half turn will keep the bit from slipping in the screw slot. Pressure and balance are supplied by both hands on the brace when driving a screw into the wood. Large screws can be driven more easily with bits than with the standard screwdriver.
- d. Phillips Screwdrivers - This screwdriver has a special slanted tip that is cross-shaped to fit into a Phillips cross-shaped screw slot. The driving method is the same as for the standard screwdriver.
- e. Offset Screwdrivers - The offset screwdriver is used to drive screws in close places where other types of screwdrivers cannot be used. There is a short blade on each end, bent in the opposite direction and at right angles to the handle. One of the blades is in the same plane as the handle. Usually it is necessary to use both ends in driving a screw.

3. Steps to Consider in More Efficient Use of the Screwdriver

- a. Bore the first hole as near the size of the screw shank as possible in the first piece of material.
- b. Bore the second hole slightly smaller than the screw root but only half the distance of the threaded part for soft wood.
- c. Countersink screw heads for flat and oval head screws. The countersink should equal the diameter of the screw head, and it should be in the large hole.

If a round-head screw is sunk below the surface, a twist drill may be used instead of a countersink. The screwdriver blade should be small enough not to damage the counterbore or surface. Flat head screws are used when plugs or dowel are inserted above the screw head.

Where very hard wood is fastened together, it may be necessary to bore a second (anchor) hole the length of the screw threads. Soap, oil, or water will make the screw enter more easily in hard wood.

Holes for very small screws can be made with an awl or other sharp, pointed instrument. This practice makes it easier to use the screwdriver.

Screws can be tapped lightly with a hammer only to set the screw in a small pilot hole before driving it into the wood. Note: A heavy blow with the hammer will mar the screw head, and if driven too deeply with the hammer, the thread-holding effect will be reduced.

4. Misuse of the Screwdriver

- a. The screwdriver is not a pry tool; therefore, it should not be used to replace such a tool.
- b. Even though the screwdriver blade is bradded on top of the handle or permanently set in a sturdy handle, it should not be used as a chisel, nor should a hammer or mallet be used on it.
- c. Screwdriver blades are usually either round or square. If a screw is hard to withdraw or set, pliers and wrenches should not be used on the blade to give the screwdriver extra power. The screw head may be sheared off or the tip of the screwdriver broken.
- d. In some cases screwdrivers are used as mixing tools for paints, glues, and oils. Unclean tips will slip out of the screw slots; therefore, they should not be used as a mixing paddle.

TYPES OF SCREW DRIVERS



Standard



Spiral-Ratchet



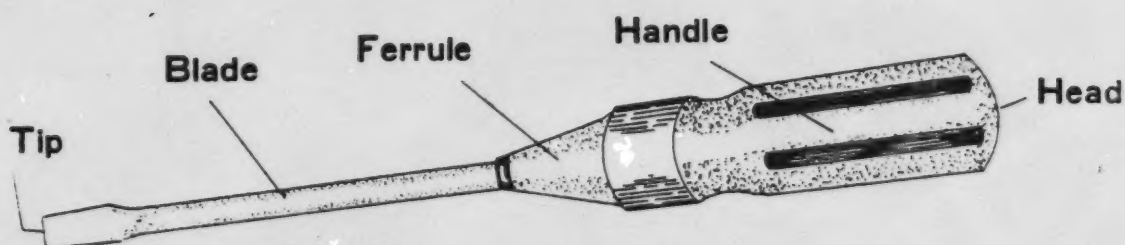
Phillips



Screw Driver Bit



Offset

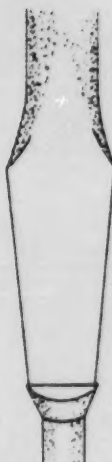


PARTS OF A SCREW DRIVER

SELECTING THE SCREWDRIVER



Tip Should Be Square



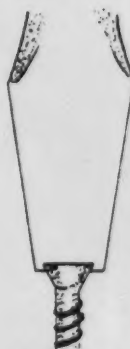
Tip Should Be Proper Width



Tip Should Be Correct Size For Screw



Correct Phillips Tip



Tip Too Wide



Tip Curved



Marred Screw Head



Screw Driver Too Small For Screw

816

USE OF THE SCREWDRIVER



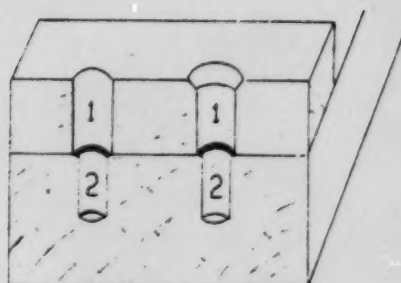
Proper Position of
Hands For Standard
And Phillips



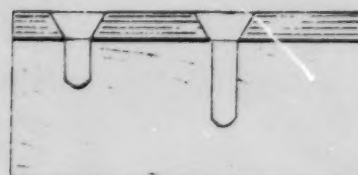
Proper Position of
Hands For Ratchet



Proper Position of
Hands For Use of
Screw Driver Bit



Hole No. 1 Is Larger
Than Hole No. 2
Fastening Wood



Hole-Soft Wood $\frac{1}{2}$ Thread Distance
Hole-Hardwood Full Length of Screw
Fastening Metal to Wood

FASTENERS

A. Identification and Use of Wood Screws, Nails, Belts, Staplers, and Other Fasteners

Suggested Procedure and Activities: Exhibits of wood screws, nails, bolts, and other fasteners may be used as a teaching aid during the class discussion.

1. Identification and Use of Wood Screwsa. Using Wood Screws Instead of Nails

Wood screws fasten pieces of wood together more firmly than nails. They also have a greater holding power.

If pieces of wood are taken apart they are less likely to split where screws are used in the place of nails.

Wood screws must be used on certain types of hardware when attaching it to wood. Screws usually match the hardware (hinges and locks).

A wood project put together properly with screws may have a more favorable general appearance than one put together with nails. Screws are usually more decorative than nails.

Transparency No. 1b. Types of Screws Used on Woodwork

Flathead Screws - These screws are the most popular for attaching or fastening pieces of wood together. They are used where the head is to be covered by a wood plug or dowel.

Round Head Screws - Round head screws are used to give the finished article an ornamental effect and when washers are used, extra holding support is furnished for the object.

Oval Head Screws - These screws are used where it is not necessary to have the screw head flush with the surface. They also give the article an ornamental appearance.

Lag or Coach Screws - The big screws resemble a bolt except on the screw root. They usually have a square head and are used where the regular screw is not strong enough for the work. Lag screws are also used with an expansion shield in brick, concrete, and rock walls.

Drive Screw - The drive screw head is similar to the flat head screw without the slot. The screw actually turns as it is being driven into the wood. It has an auger-type root instead of a threaded root.

Phillips Screw - The only difference between the flat head and Phillips screw is the straight

single slot in the flat head screw and the cross-shaped slot in the Phillips screw. The two types of screws can be used for the same purposes. The recessed Phillips screw requires a special screwdriver. It is considered to have a greater drawing power than the regular head screw.

c. Metals and Finish of Wood Screws

Screws are made of steel, brass, alloy, bronze, and copper metals.

Steel screws are used for ordinary work, and they are cheaper than bronze and copper screws.

Brass and alloy-type screws are best suited for construction purposes where the screw is subjected to moisture.

Copper screws are used mainly with copper metals, giving the finished product an ornamental appearance.

Screws are finished in many colors. They are: bright metal, blue, brass, bronze, and copper. Some screws are painted in various colors.

Screws are identified according to length, guage, finish, and head. For example: a 1- $\frac{1}{4}$ inch number 10, flathead steel screw is written 1- $\frac{1}{4}$ " - No. 10 F. H. S., and the same screw in brass, but round head, is written 1- $\frac{1}{4}$ "-No. 10 R.H.B. The guage number of screws range from 0 to 24 and the length from $\frac{1}{4}$ to 5 inches.

d. Tools Needed to Drive Screws

Screwdrivers, hand drills and bits, counter-sink bit, awl, or a tool to start screw hole, and brace and screwdriver bit.

2. Identification and Use of Nails

a. The nail is one of the most commonly used rough hardware.

Nailing was one of the first ways used to join pieces of wood together. The early nail had four flat sides instead of being round. It resembled our present day horse-shoe nail.

The term "penny", indicating the common nail size (length), came from one of the following sources of measurement in England.

Six-penny and ten-penny nails could be purchased for either a six-pence or ten-pence per 100 nails.

One thousand nails of a certain size (six-penny) weighed six pounds.

The letter "d" is used as a symbol for penny.

Transparency No. 1

- b. Types of nails most commonly used are: common, box, finishing, roofing, flooring, plasterboard, casing, and shingle. The two general types of nails are wire cut or cut nails.

Common Nails - These nails are used more frequently than any other type of nail. They are made of wire, have flat heads, and range in size from 2d to 60d. The larger common nails are known as spikes. They are used for rough work where holding power is important. They are used mainly on rough work such as framing, fencing, and form building.

Box Nails - Box nails range in size from 2d to about 40d. They have less tendency to split the lumber than does the common nail due to their being smaller in diameter. The box nail is used for building crates, boxes, and the nailing of siding. They are also made of wire and have flat heads.

Finishing Nails - These nails are used for finish work. The heads are small and barrel shaped so they can be sunk below the surface and the holes filled with a wood filler or putty. The sizes range from 2d to 20d. These nails are used on cabinet trimmings and cupboards.

Roofing Nails - Roofing nails have a very large flat head. The shanks are of different sized and types. The most common shank is barbed. The nails are used to install rolled or shingle asphalt roofing. They range in size from about 3/4 to 2 inches. These nails are galvanized.

Flooring Nails - As the name indicates, these nails are used mainly for nailing flooring; but they are used on other heavy materials. The nail diameter and head is slightly larger than the finish nail; however, the head can be countersunk. The flooring nail ranges in size from about 7d to 10d.

Plasterboard or Gypsum Board Nails - These nails are small with a flat head. They range in size from 1 - 1-1/4 inches in length. They are used to join plasterboard to a wood base. These nails are also used to apply rock lath (a base for plastering).

Casing Nails - These nails can be used for flooring, but they have a smaller head and smaller shank in diameter than does the flooring nail. The head can be countersunk. These nails range in size from 4d to 40d and are used mainly for outside finish work. They are thicker than a finish nail.

Shingle Nails - Nails of this type are small (3d to 6d) with flat heads. The galvanized box nail is used for wood shingels.

Hinge Nails - There is one other type of nail that is being used for lattice work and roofing because of its holding power; and that is the hinge nail. They have oval or countersunk flat heads and range in size from 4d to 20d.

Other Types of Nails - Other types of nails are: masonry, duplex-headed, ratchet, T, copper clout, lead-capped metal roofing, screw and plain shank roofing, and escutcheon pin.

- c. Nail length can be determined in the following manner: A 2d nail is one inch in length and each size thereafter increases $\frac{1}{4}$ inch in length through the 16d nail. For example; a 6d nail is 2 inches and 7d is 2- $\frac{1}{4}$ inches in length. The gauge also becomes larger if the length increases more than two sizes between 4d and 12d nails.

Transparency No. 2

- d. Steps to follow when driving a nail are as follows:

After the proper nail has been selected, hold it firmly with the thumb and fingers of one hand, then strike a light blow with the hammer to set the nail for driving.

If more than one nail is used they should be set in a zig-zag line to prevent splitting the wood.

If nails are driven in hardwood, drilling a hole slightly smaller than the nail will prevent the wood from splitting.

Nails driven diagonally will have a better holding effect than nails driven straight into the lumber. Toe-nailing is another way of driving nails at an angle.

The last blow of the hammer should be judged properly in order not to leave a hammer face mark on the board.

Finish, casing, and flooring nails may be set by using a nail set slightly smaller than the head of the nail.

Nails should be clinched across the grain of the wood. Hitting the point of the nail after it has been clinched flat on the surface will make the nailed material safer to handle.

3. Identification and Use of Bolts

- a. There are two main purposes for using bolts as fasteners.

Bolts are considered the strongest of all fasteners for wood. They are used where a strain is put on pieces of boards that are jointed together.

Bolts are used in heavy construction where it is necessary to assemble and disassemble objects.

Transparency No. 3

- b. Types of bolts most commonly used are: carriage bolts, toggle bolts, and lag bolts with shields.

Carriage bolts are generally considered the woodwork type bolt due to the square shank under the round oval head. The square shank prevents the bolt from turning once it is set in the wood. The head cannot be held by a wrench; therefore, it may be difficult to remove, especially if the bolt is covered with rust. The length may range from about 1 inch to 20 inches. These bolts are threaded like machine bolts.

Stove bolts are used for lighter work than are carriage bolts. They have round and flat slotted heads and may be loosened or tightened with a head screwdriver. The stove bolt may be purchased with a Phillips head and in many sizes. The threads extend the full length of the bolt. The length of stove bolts range from 3/8 inch to 6 inches.

Machine bolts may be used for heavy construction such as livestock feeders, gates, and trusses for buildings. The head of machine bolts can be held with a wrench while it is being tightened. The size range is similar to a carriage bolt, about 1/2 to 1 inches in diameter, and the length is from 1 to 30 inches. These bolts are used for heavy construction.

Toggle bolts are supplied with a spreading head nut that opens as it passes through the wall; therefore, its main purpose is to fasten objects by drilling a hole and inserting the spreading nut through the hole. It is tight-

ened with a screwdriver.. The bolt is designed to join small objects to walls and other objects.

Lag bolts are used with expansion shields to fasten wood and other materials to concrete, bricks, and stone. When a lag screw or bolt is inserted into a metal shield the shield expands in the hole as the square head of the bolt is turned clockwise with a wrench. This bolt does not have a nut. When attaching metal to wood or wood to wood it is necessary to drill two sizes of holes-one for the threaded part and one for the non-threaded part.

Anchor bolts are used to fasten sills and plates to concrete foundations and walls. They can be made in various lengths. Usually only one end of this bolt is threaded.

- c. Washers and nuts are necessary when tying wood or metal to concrete, metal, and wood.

Plain washers are usually used with many different types of bolts in woodwork. It is necessary to use washers on both ends of machine bolts and round headed stove bolts if two pieces of wood are joined together. The head end of a carriage bolt may not require a washer due to its having a round flat head. Lock washers are usually used against metal on the nut end of all bolts except the expansion bolt, if it is necessary to permanently set the nut.

Four types of nuts are listed as follows:

The square nut is the most commonly used for agricultural work.

The hexagon nut is seldom used for woodwork.

The castellated nut has an outward slotted lip which holds it in place by a cotter pin. It is seldom used with wood objects.

Thumb nuts or wing nuts are used where frequent adjustment is necessary.

Two ways of removing old rusted bolts and nuts are:

A slot is cut in the top of a carriage bolt with a hacksaw so the bolt can be held with a heavy duty screwdriver while the nut is being loosened. Also, two sides of the head can be cut off, forming a wrench surface for holding the bolt while the nut is removed.

A slot may be cut in the nut end of the bolt and a screwdriver used to keep it

from turning while the nut is being removed.

Transparency No. 3

4. Use of Corrugated Fasteners and Staples

Corrugated fasteners are used to join boards together such as corners and butt joints in windows and doors and corners for picture frames.

The thickness of the corrugated fastener should be at least 1/8 inch less than the thickness of the board where it is used.

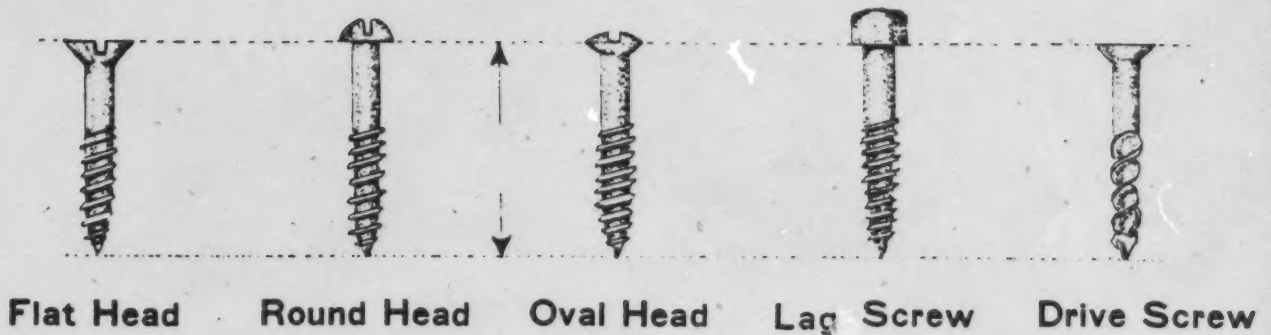
The fasteners range in size from 1 to about 6 inches in width and from 1/4 to 1 inch in depth. Regardless of the width of the fastener, it should be driven evenly into the material. Hammer blows should be placed so that it enters the board straight and parallel.

Staples range in sizes from 3/8 inch to 2 inches. Wide crown staples have a 1 inch crown. They are used with a staple gun. Staples are used for millwork, asphalt shingles, butt joining, and ceiling materials.

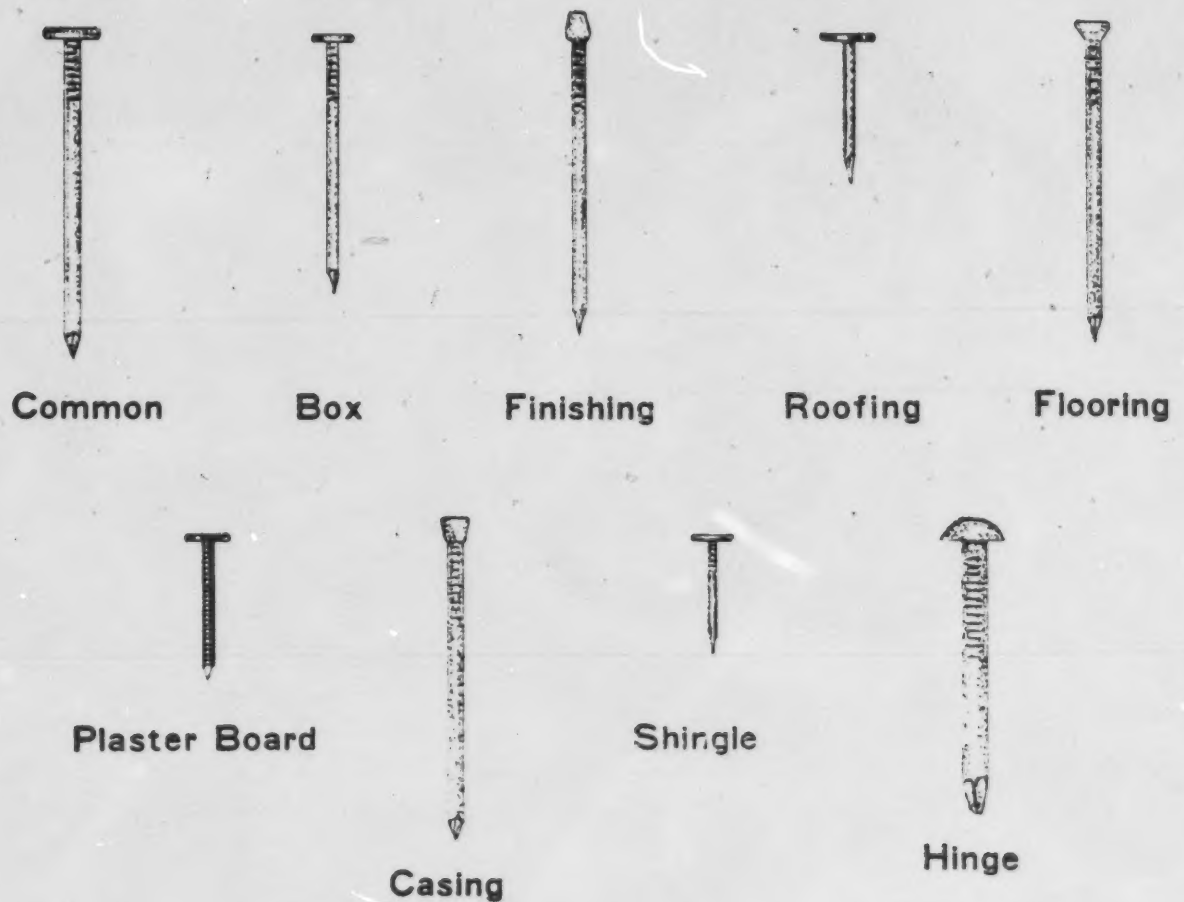
Wire staples are made in different sizes. The staple used to construct barbed wire and heavy net wire fences may be about 1 inch long, while the small mesh wire staple may be less than 3/4 inch in length. Fencing staples vary in length from about 3/4 inch to 2 inches.

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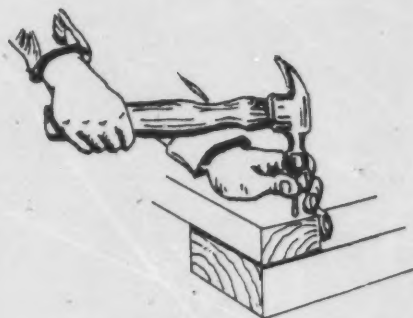
TYPES OF WOOD SCREWS



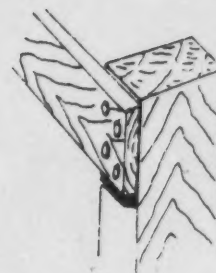
TYPES OF NAILS



DRIVING NAILS



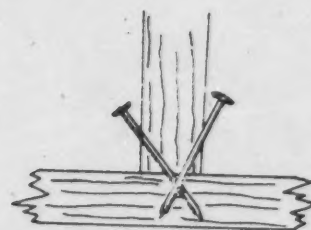
**HOLD NAIL WITH
THUMB AND FOREFINGER**



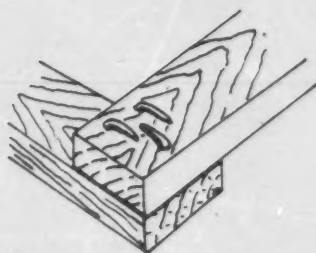
ZIG ZAG NAILS



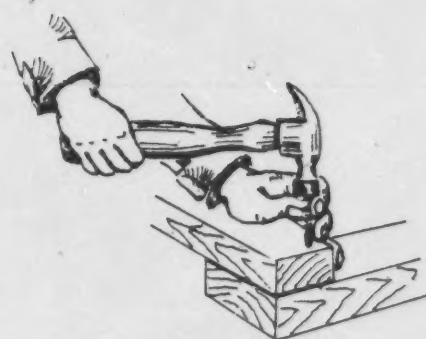
**NAILS DRIVEN AT AN ANGLE
GIVE MORE STRENGTH**



TOE NAILING



**CLINCH NAILS
ACROSS GRAIN**

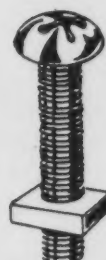


**SET FINISHING, CASING
AND FLOORING NAILS
IF NECESSARY**

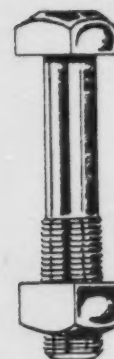
TYPES OF BOLTS AND OTHER FASTENERS



Carriage



Stove



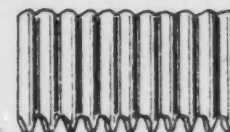
Machine



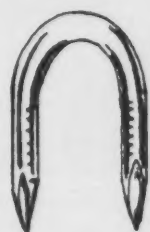
Toggle



Expansion



Corrugated fastener



Wire staple



Standard staple



Use of corrugated fastener

USING ROPE IN ANIMAL AGRICULTURE

1. Finishing the End of a Rope
2. Splicing a Rope
3. Tying Various Knots
 - a. Tying Two Ropes Together
 - b. Tying Loop Knots
4. Making Rope Halters
5. Making Livestock Tackles
6. Making a Livestock Back-Rubber

The history of rope and knots is so dim and ancient that really little is known of their origin. The earliest human beings used cordage of different kinds and by his/her ingenuity succeeded in tying materials together. Knots of various forms are shown in ancient carvings and decorations of prehistoric people.

Rope has played an important role in the development of agriculture. Much of the early harness was mostly rope. Nearly every farm had its big hay rope that was used to pull loose hay into the haymow. Today much of the loose hay has been replaced by bales and leather has replaced the rope in harness. Rope, however, is still used for lariats, lunging lines, halters, animal ties, and casting ropes. Steel rope (cable) is used in winches and elevators.

Many splices, end finishes, knots, and hitches are necessary for proper use of manila rope. This subject-matter unit discusses a number of these with line drawings for clarification.

1. Finishing The End Of The Rope

The ends of a rope should be whipped with a cord or finished with one of the crown splices to prevent untwisting or unlaying.

Whipping

The common whip is made by laying a narrow loop of cord about 2 inches along the rope with the open end away from the end of the rope (Fig. 1a). Hold the open end of the loop against the rope until you begin the winding. Start near the open end of the loop and wind the long end of the cord closely around the rope (Fig. 1b), almost to the end (Fig. 1c). Then, thread the end of the cord through the loop (Fig. 1d), pull the loop halfway under the windings with the other end of the cord, and cut off both ends of the cord, even with the windings (Fig. 1e).

The plain ship is similar to the common whip, yet slightly different. To make it, lay the end of your cord along the rope and bind it down with a couple of



Fig. 1. Whip the end of a rope to prevent it from untwisting or unlaying.

twists around the rope (Fig. 2a). Then, lay the other end on the opposite way (Fig. 2b), and bind it down with a couple of twists with the bight of whipping (Fig. 2c), and pull this end tight (Fig. 2d).

The palm and needle whip is more permanent than the two previously discussed. To make it, push a threaded needle through the middle of a strand so that it comes out between two strands on the other side (Fig. 3a). Then, bind the end down with six or eight turns toward the end of the rope (Fig. 3b), and again push the needle through the middle of a strand so that it comes out between strands near the end of the rope (Fig. 3c). Finish the whip by wrapping the cord around it between each pair of strands (Fig. 3d) and ending the cord through a strand again (Fig. 3e).

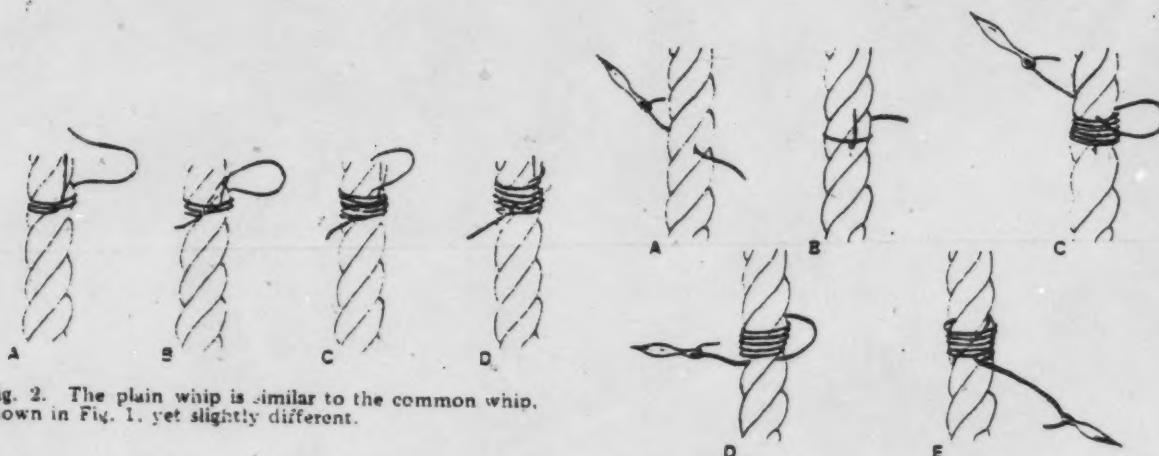


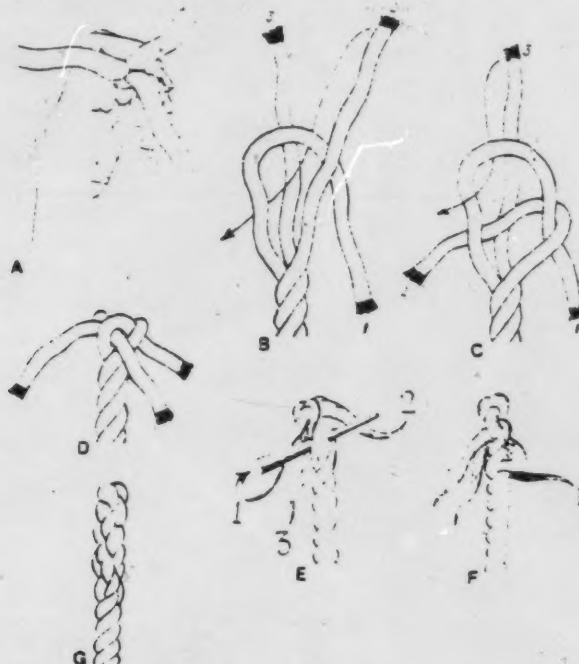
Fig. 2. The plain whip is similar to the common whip, shown in Fig. 1, yet slightly different.

Fig. 3. The palm and needle whip is used in the Navy. It is more permanent than the other two.

Spliced crown

The spliced crown may be used to finish the end of a rope, where an enlargement on the end of the rope is not objectionable. To make it, unlay the strands of the rope and spread them as shown in Fig. 4a. Then, cross strand 1 in front of strand 3, but under strand 2. Move strand 3 under the U-loop of strand 1, but in front of strand 2 (Fig. 4b) and form the crown by pulling all the strands down tight (Fig. 4c). This forms a solid, three-cornered knot on the end of the rope. Weave the ends back into the rope (Fig. 4d). Start with any end, such

as 1 and put it over the first strand and under the second (Fig. 4e). Then, turn the rope $1/3$ turn and do the same for strand 2, and finally strand 3. Pull the strands down tight, keeping them at about right angles to the strands of the main part of the rope (Fig. 4f). Tuck the strands into the rope 2 or 3 more time, pulling them good and tight each time. Cut off the strands to about $\frac{1}{4}$ inch long and smooth the splice by rolling it under your foot on the floor (Fig. 4g.). If you desire a tapered splice, cut out part of each strand before making each of the last two tucks.



Wall knot with crown

The wall knot with crown may be used to prevent the end of the rope from slipping through a small opening and to prevent the end of a rope from untwisting when a knot on the end is not objectionable. To make it, unlay the strands of the end of a rope about five turns and spread the strands as shown in Fig. 4a. Move strand 1 around back of strands 2 and 3 and across the front side of the rope, holding it in place with the thumb of the left hand (Fig. 5a). Move strand 2 down and around strand 3 (Fig. 5b), and strand 1 down and around strand 2 (Fig. 5c) and up through the loop of strand 3 (Fig. 5d). Pull the ends down firmly by pulling the strands at right angles to the rope and working the knot down against the twisted part of the rope. This makes the wall knot, but if a crown is desired, add it as described for Splice Crown (Fig. 4).

(SEE DIAGRAM NEXT PAGE)

2. Splicing a Rope

Splicing is a method of permanently joining the ends of two lines or ropes and in making a loop or eye. Two splices, known as the short splice and the long splice, are used in joining ropes. In making a splice there are three steps: (1) unlaying the strands, (2) placing the ends together, and (3) tucking or weaving the ends of the strands into the rope. The weaving of the strands is done in the same manner as for the end splices.

Short splice

This splice is about as strong as the long splice but practically doubles the size of the rope at the splice. It is used when the rope does not have to pass through a small pulley, or when only a short length of the rope can be spared for the splice. To make the splice, unlay the strands of the two ends for 5 to 7 turns. Spread the strands on each rope so the strands branch out from the rope and none of them cross over in the center. (Fig. 4a). Bring the two ends of ropes together so that the strands of one end alternate with the strands of the other (Fig. 6a). Next tie the corresponding strands with a simple over-hand knot (Fig. 6b) and work the knots down into the rope as smoothly as possible. Next, take one of the strands from the left and pass it over the nearest one from the right and under the next. Rotate the rope and follow the same procedure with the other strands (Fig. 6c). Give each strand two more tucks to complete the splice (Fig. 6d), and cut off the ends of the strands. If you wish to taper the splice, cut one half of each strand and tuck them once more. Roll the finished splice under your foot to smooth it.

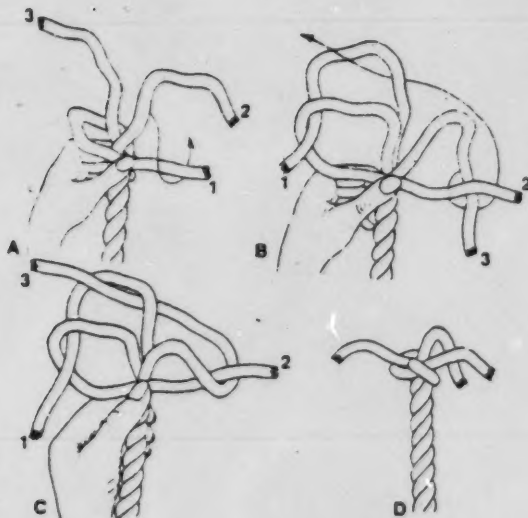


Fig. 5. Wall Knot

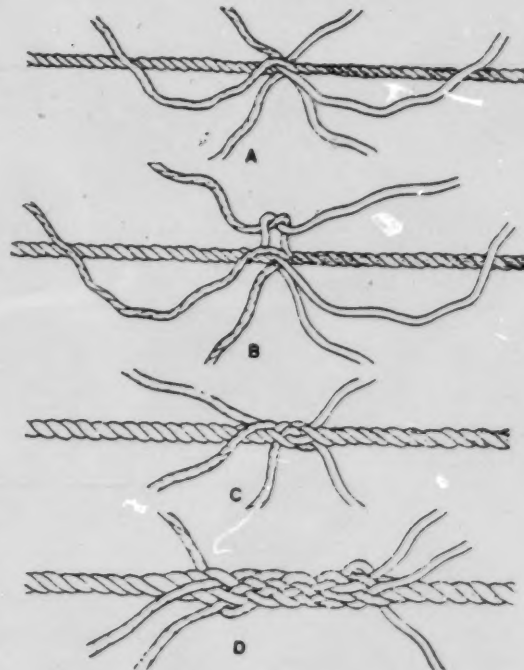


Fig. Sort-Spliced

To tuck the strands, untwist the rope slightly. This will loosen the strand enough that you can put your finger or a stick under it (Fig. 7a). Then, the loose strand may be pushed under it as the finger or stick is removed (Fig. 7b).

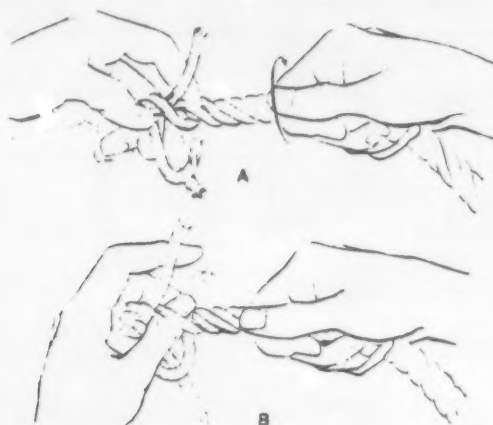


Fig. 7. Tucking the strands

Long splice

The long splice is used to join ropes that cannot be enlarged as much as with the short splice, such as a rope that runs through a pulley. To make a long splice, unlay the strands of each end of the rope about 15 turns. Then, bring the two ends together so the strands alternate, as with the short splice (Fig. 8a). Tie one pair of strands with a common overhand knot (Fig. 8b) and draw it up tight. Next unlay one strand of the rope from the right end for about five turns, replace it with the corresponding strand from the left end (Fig. 8c), and tie them together with an overhand knot (Fig. 8d). Repeat this process by unlaying the remaining strand from the left end about five turns, replacing it with the remaining strand from the right end, and tying them together with an overhand knot. The splice should now look like Fig. 8e. Cut off all of the strands to about 6 inches long and finish the splice by weaving or tucking each of the strands into the rope as used in the crown splice or the short splice. After all six strands have been weaved into the rope, the finished splice should look like Fig. 8f.

Spliced eye

The spliced eye is used to make a permanent loop in the end of a rope or to fasten a rope to a ring. It is made by splicing the three strands of the end of the rope into the side of the same rope. To make it, unlay the strands of the rope about five turns and double the end of the rope back, forming of loop of desired size. If a ring or a snap is to be fastened to the loop, be sure to put it on at this time. Spread out the strands on the main rope as shown in Fig. 9a. Put strand 1 under a strand of the main rope (Fig. 9b), strand 2 over strand 1 and under the

next strand of the rope (Fig. 9c); and strand 3 over strand 2 and under the next strand of the rope (Fig. 9d). Pull all three of the strands up tight and weave them down the rope, over and under the strands as shown for the crown splice. Taper if desired by cutting parts of each strand before tucking it the last time or two. Roll the splice under your foot on the floor to smooth it up (Fig. 9e).

The splice of the spliced eye is wrapped (served) sometimes for looks and durability. To serve a splice, wrap it with twine as explained for whipping the end of a rope (Fig. 10a, b, c, and d).

Spliced loop

A spliced loop is a permanent loop or eye in a rope at any place other than the end of a rope. It has many uses--one of which is the side loop on a rope halter. To make a spliced loop, raise a strand in the rope 2, at the desired location for the loop, and pass the end of part 1 through it (Fig. 11a) till the loop is the desired size. Then, raise a strand on part 1 rope (Fig. 11b) and pass the end of part 2 rope through it (Fig. 11c), and pull it up tight (Fig. 11d).

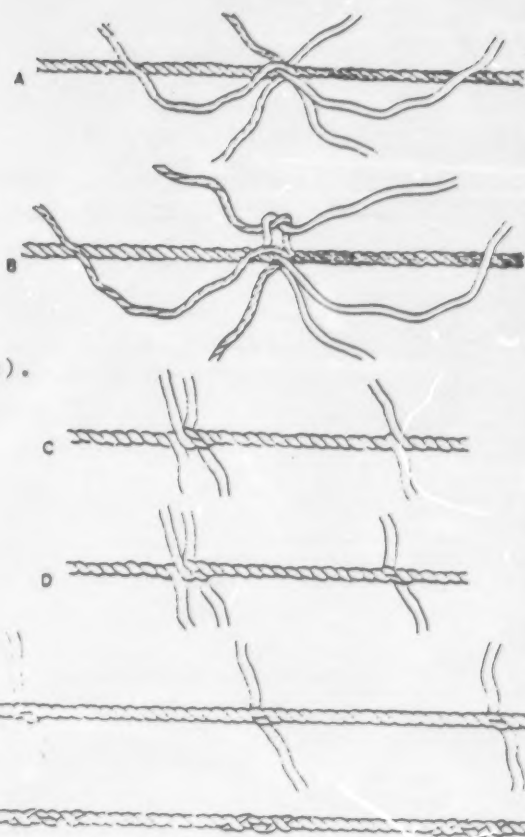


Fig. 8. Long Splice

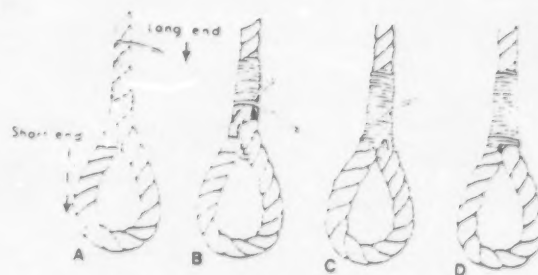


Fig. 10. Serving a spliced eye

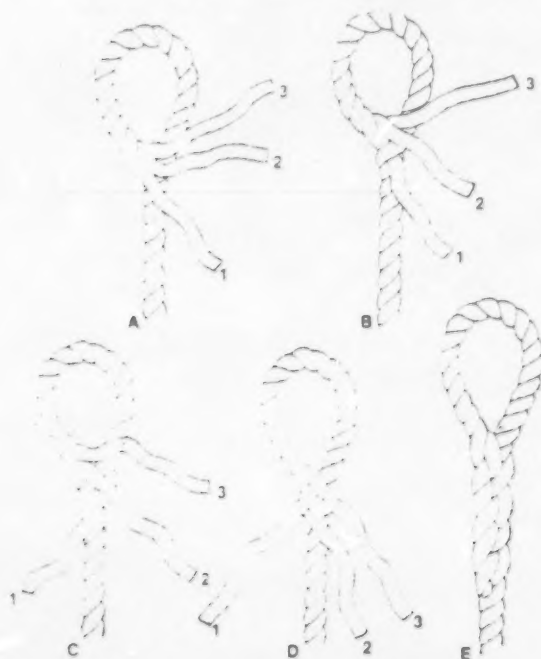


Fig. 9. Spliced Eye



Fig. 11. Spliced Loop

3. Typing Various Knots

Knowing the right knots to use in different situations and being able to tie them when the need arises is a very important asset in anybody's life. Knots and hitches are used in many emergency situations and often have to be tied right and quickly to meet the emergency. They may also be used for fastenings that need adjustment from time to time.

Before attempting to tie knots, be sure you know the important parts of a knot. They are: the bight (A), the loop (B), and the round turn (C) (Fig. 12).

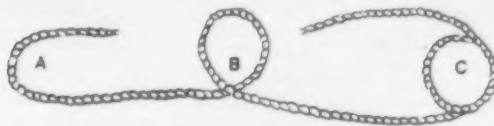


Fig. 12. Parts of a knot



Fig. 13. Overhand Knot

Tying Two Ropes Together

Overhand knot

The overhand knot (Fig. 13) is the simplest of all knots. It may be used on the end of a rope, but is more often used as the first part of other knots or hitches. After pressure has been applied to it, it is often difficult to untie.

To tie an overhand knot, make a loop in the rope and pass the end through the loop. The same knot can be tied by crossing the ends of two separate ropes and giving one a complete turn around the other.

Figure-eight knot

This knot is also used for making a knot at the end of a rope or for preventing the strands from untwisting. It is an easy knot to untie after pressure is released from it.

To tie the figure-eight knot, form a bight near the end of the rope; give the end of the rope one complete turn around the rope; and pass the end through the loop (Fig. 14).



Fig. 14. Figure 8 Knot



Fig. 15. Square Knot

Square knot

This is the knot commonly used in tying two cords together. It is very strong, never slips or becomes jammed, and is easily untied. To make the square knot, tie an ordinary overhand knot with the two ends (left over right) as shown in Fig. 15a. Follow this with another overhand knot but right over the left (Fig. 15b and c).

Granny knot

The granny knot has much the same appearance as the square knot and is often tied when the square knot is intended. It slips under strain and is not very useful. Tie it with two overhand knots, like the square knot, except both knots are tied left or right. In the granny knot, the two ropes come out of the bight separated by the rope of the bight (Fig. 16).



Fig. 16. Granny Knot



Fig. 17. Open-Hand or Binder Knot

Open-hand or binder knot

This is the knot tied by the grain binders of 40 years ago. It is still one of the simplest knots for tying two ropes together, especially two ropes of different dizes. It is quickly and easily tied, and does not slip easily, but is fairly large and clumsy and is difficult to untie. To tie the open-hand knot, lay the two ends together and tie an overhand knot in them (Fig. 17).

Weaver's knot

The weaver's knot, also called the sheet bend or becket bend, looks about like the square knot. It is a useful knot for tying two ropes together, especially ropes of different sizes. It does not slip easily and is easy to untie. To tie the knot, make a bight in one end of the rope. Then, pass the end of the second rope through the bight, around the first rope at the neck of the bight, and back under itself on top of the bight (Fig. 18).

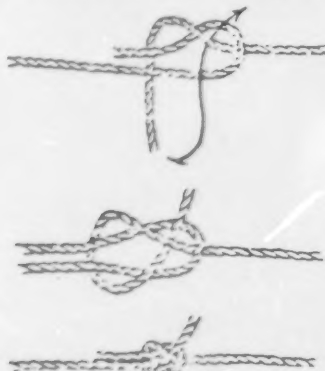


Fig. 18. Weaver's Knot



Fig. 19. Slip Knot

Tying Loop Knots

Loop knots involve only one end of a rope. They include the slip knot, manger knot, bowline on the bight, and lariat knot.

Slip knot

This is the simplest loop knot possible for tying a loop around an object. It will pull up tight around the object and is often difficult to untie. To tie the slipknot, make a bight in the rope or pass the end around an object and tie it around the main part of the rope using an overhand knot. (Fig. 19).

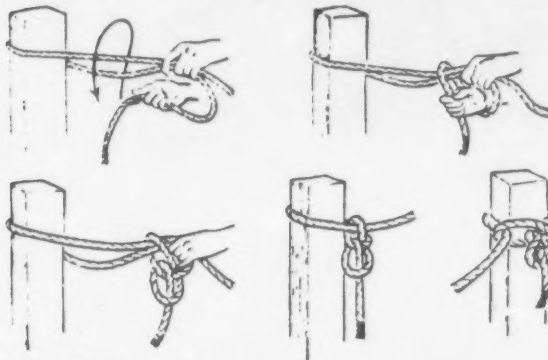


Fig. 20. Manger Knot

Manger knot

The manger knot, sometimes called the hitching knot, is commonly used to tie an animal to a hitching post or manger. It is quite similar to a slip knot but is much easier to untie. To make the knot, start as in tying the slip knot, but instead of pulling the rope clear through when making the overhead knot, pull only a loop, and pass the end of the rope through this loop (Fig. 20).

Bowline knot

The bowline knot is most useful when a loop knot is needed that will not slip or draw tight around the object and will still untie easily. To tie the bowline, make a loop in the rope near the end. Then, pass the end through the loop (Fig. 21a), around the main part of the rope (Fig. 21b), and back through the loop again (Fig. 21c).

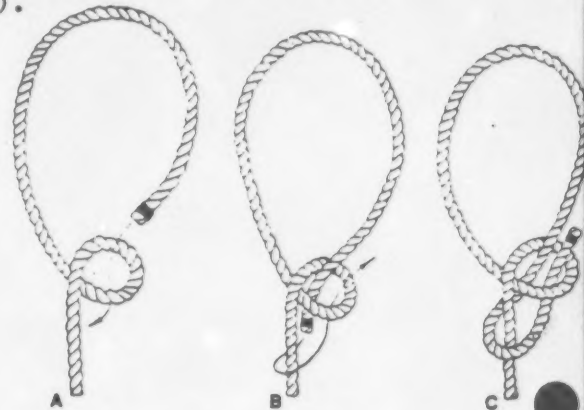


Fig. 21. Bowline Knot

Bowline on a bight

This is, also, sometimes called a double bowline. It is a useful knot to tie in the middle of a rope. It holds well and is easy to untie. To tie the knot, make a loop in the doubled rope and pass the doubled end through the loop (Fig. 22a and b). Then, bring the doubled end down (Fig. 22c), and slip it over and back up around the loop (Fig. 22d).

Lariat knot

The lariat knot, as the ~~830~~ ⁸³⁰ indicates, is used in



Fig. 22. Bowline on a Bight

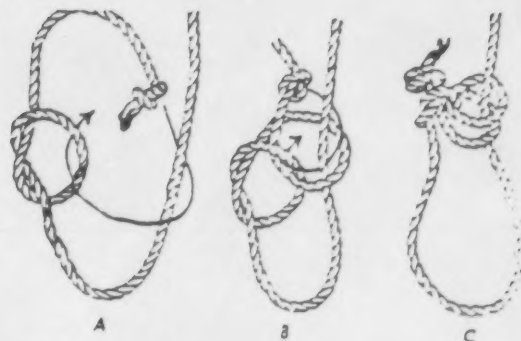


Fig. 23. Lariat Knot

making a lariat. To tie the knot, tie two overhand knots, one at the end of the rope and drawn up tight and the other 12 to 14 inches from the end and drawn up loosely (Fig. 23a). Then, pass the knotted end around the main part of the rope and through the loop of the loosely tied overhand knot twice (Fig. 23b). Pull the overhand knot tight to prevent the end knot from slipping back through it (Fig. 23c).

4. Making Rope Halters

Halters, for cattle and horses, may be made out of rope. They may also be adjustable and nonadjustable.

Nonadjustable halter

The nonadjustable rope halter may be used for cattle without horns and as a temporary halter for horses and young stock. The amount of rope to use and the length of the different parts can be gotten by measuring the animal.

To make the halter, make a loop splice at 3 leaving a loop 1 to 1½ inches in diameter and pull tight (Fig. 24a). Unlay end 1 of the rope 5 turns and weave it into rope 2 at 4 (Fig. 24b) in the same manner as in making the spliced eye. Put the long end of rope 2 through the loop 5 and the halter is completed (Fig. 24c).

Nonadjustable halter with guard loop

This halter is made so that it will not pinch the head or nose of the animal. It is especially recommended for horses. The length 1 to 4 (Fig. 25) needs to be enough longer than that of the nonadjustable halter to form the loop. Otherwise, the measurements would be the same.

Form a loop splice, as illustrated in Fig. 24, for the nonadjustable halter (Fig. 25a). Unlay end 1 until 2-3 is 13 inches long. Weave the strands of 1 into the rope three times at 5, which is about 38 inches from 4 (Fig. 25b). Then, relay the strands of 1 as far as 6, which is 6 inches from 7 (Fig. 25c). Put the long end of the rope through loop 8 and weave the strands of 1 into the rope (Fig. 25d).

Adjustable halter

This halter can be adjusted for different sizes of

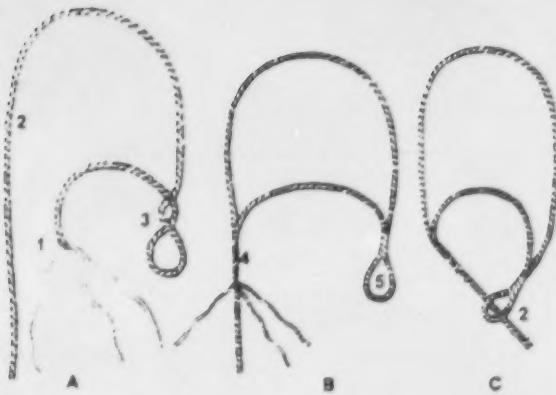


Fig. 24. Nonadjustable Halter

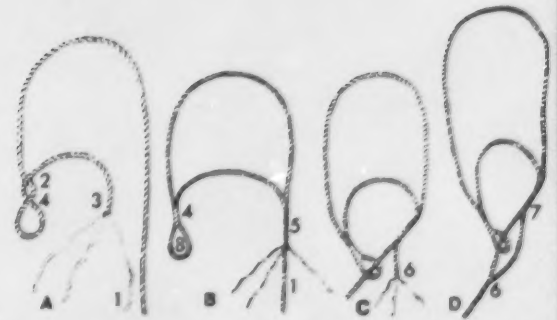


Fig. 25. Nonadjustable Halter with Guard Loop

animals and especially for horned cattle. To make this type of halter, form a loop splice as illustrated in Fig. 24 for the nonadjustable halter. Then, put a spliced eye about 1 inch in diameter in the end of rope A (Fig. 26). Put the long end of the rope through the loops 1 and 2 and the halter is completed.

Emergency or temporary halter

A halter for emergency use is easily and quickly made. Tie an overhand knot in the doubled rope at 1 and a bowline knot at 2 (Fig. 27a). Then, run the lead rope through the loop at the overhand knot and the halter is finished (Fig. 27b).

A simpler, more quickly made emergency halter is shown in Fig. . To make it, tie a bowline knot in end A. Put the long end of the rope over the head of the animal, around in front of the nose, through the loop of the bowline, around behind the jaw, and then cross at B.



Fig. 26. Adjustable Halter

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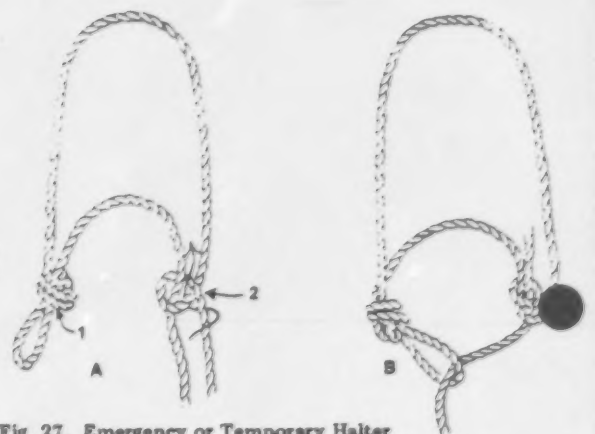
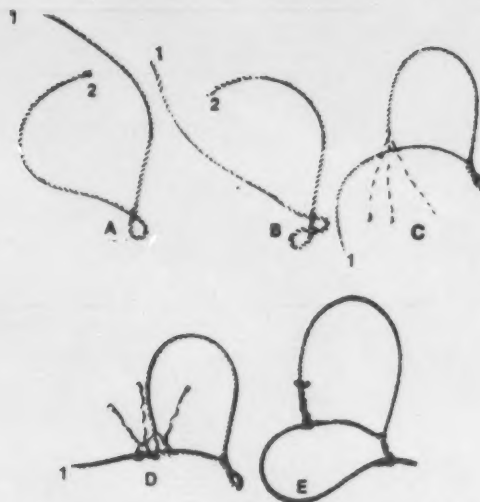


Fig. 27. Emergency or Temporary Halter



Calf halter Fig. 28. Calf Halter

This halter was designed primarily for calves and is popular with calf-club members. Because of the nonadjustable head piece, the animal cannot work it off the head or cause it to slip back on the neck.

Use about 12 feet of half-inch rope. Raise two strands about 33 inches from one end and push end 2 through the opening until a loop about one inch in diameter is formed (Fig. 28a). Next, raise two strands of the shorter end 2 just above the loop and push the longer end 1 through the opening (Fig. 28b). Draw it up firm against the loop. Unlay the strands of end 2 about 8 inches, as shown in Fig. 28c). Then, wrap them around the rope and weave them back into the headpiece like an end splice (Fig. 28d and e).

5. Making Livestock Tackles

Leading or tying tackle

The tackle illustrated in Fig. 29 may be used to break a colt to lead or from pulling back when tied. To make the tackle, run the rope around the horse's body just behind the front legs and tie it with some kind of knot that will not draw too tight for untying. Then, run the rope between the horse's front legs and through a loop or strap in the halter ring.

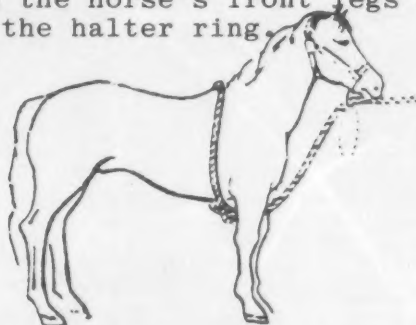


Fig. 29. Leading or tying tackle for horses.

Casting tackle for horses

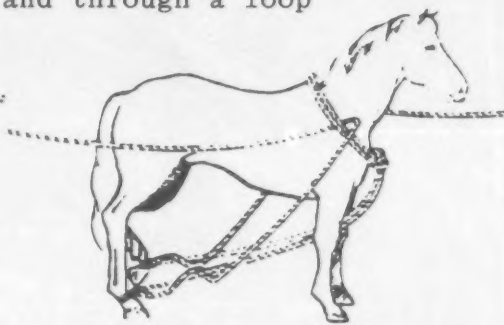


Fig. 30. Casting tackle for horses.

A safe means of throwing a horse is with a tackle. To make the tackle, tie a bowline on the bight and place it over the horse's head much like a horse collar (Fig. 30). Then run the ropes between the front legs and through

rings on ankle bands on the hind feet. Wrap each rope around itself once then under the doubled rope around the neck and extending one rope to the front of the horse and the other to the rear (Fig. 30). To throw the animal, back it and tighten the ropes at the same time.

Casting tackle for cattle

A simple and effective tackle for casting cattle is shown in Fig. 31. To make the tackle, tie one end of a rope around the animal's neck with a bowline knot. Then, put the rope around the animal's body just back of the front legs and make a half-hitch at the withers and around the body again at the rear flanks with another half-hitch. The rope should be in front of the left hipbone at A and behind the right hipbone at B. To throw the animal, pull the rope to the rear and to the side upon which the animal is to be thrown.

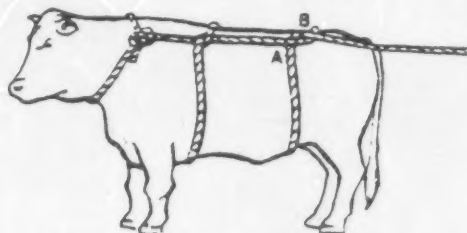


Fig. 31. Casting tackle for cattle.

6. Making a Livestock Back-Rubber

Back rubbers for cattle give effective control of horn flies and help keep lice under control. They are less expensive and require less labor than other control measures. The animals do not have to be herded into pens for treatment and unnecessarily excited.

Back rubbers of various types are available at most livestock supply stores, but may also be made out of used baler twine. To make one 15 feet long, you will need a supply of baler twine, 2 iron rings 3 to 5 inches in diameter, and 2 stakes.

First, separate the used twine into hanks of 25 strands each, preferably with the knots removed. The individual strands can be from 4 to 10 feet in length, but make each hank out of 25 pieces of about the same length.

Then, lay out the hanks of twine, so that each successive hank will overlap half of the previous hank. Continue this process with additional hanks until you have laid enough twine to measure three times the length of the finished product plus about four feet. A back-rubber 15 feet long would require 49 feet of twine hanks.

Next, drive two stakes into the ground, or nail them to a board, spaced as far apart as you want your finished back-rubber to be.

The laid out mass of twine is now 50 strands thick except at the two ends. So fold these two ends back until they touch the next hank. Now the twine is 50 strands thick for its full length.

Twisting the twine comes next. Twist the hanks counter clockwise tightly together to form a single strand approximately 45 feet long. Twist the twine from the end where you started laying out the hanks until it starts to kink.

Place the 2 iron rings on the twisted strand at $\frac{1}{3}$ the distance from each end. Slip the rings over the stakes in the ground (or on the board), which have been spaced about 15 feet apart. Then, take each end of the rope to the opposite post to form 3 equal parallel strands.

Now, pass the loose-end loop through the ring at each end, and double the loop back over the ring. The rings, then, become the ends of the back-rubber.

To finish the back-rubber, slip the rings off the stakes and let go. The twist in the twine will cause the strands to twist by themselves into a thick, three-strand back-rubber approximately 15 feet long. Repeat this operation for as many back-rubbers as you need.

Use the back-rubbers where the cattle tend to loaf-near water, salt, or shade.

References:

1. Using Rope in Animal Agriculture, Vocational Instructional Materials, University of Illinois.

Computation of Bills of Materials

A. Lumber Identification and Computation of Bill of Materials.

Suggested Procedure and Activities: Pieces of lumber of all dimensions showing the different grades; miniature structures and building plans with bills of material; and carpenter's steel squares.

1. Identification and Selection of Lumber

There are two main classifications of lumber: softwoods and hardwoods. Softwood lumber is cut from pine, cedar, fir, redwood, and cypress. Hardwood lumber is cut from oak, ash, birch, walnut, hickory, and maple. Most farm buildings are constructed of softwood.

There are two general grades of softwoods; select and common. The select grade is divided into four subgrades: A, B, C, and D. The common grade is divided into five subgrades: No. 1, No. 2, No. 3, No. 4, and No. 5. Grades 4 and 5 are usually designated as utility grade.

The two highest grades of hardwoods are called FIRSTS and SECONDS. They are commonly sold together and designated as "FAS". The lower grades of hardwood are the same as for softwoods.

2. Description and Uses of Lumber Grades

The select grades, A, B, C, and D, are for the most part free of knots and blemishes. Select grade lumber is relatively straight grained and is used for fine finish work.

Common grade No. 1 is a general-purpose wood. It may have sound, smooth knots up to about two inches in diameter. Common grade No. 2 is often used for framing or flooring and has slightly larger knots and other blemishes. Common grade No. 3 has loose knots, occasional knotholes, and a limited amount of pitch and season checking. It is used sometimes for framing and shelving. Utility common grades No. 4 and No. 5 are poor quality and are used primarily for temporary structures and crating jobs requiring little strength.

Lumber may be purchased dressed on all four sides (S-4-S), dressed on one side and one edge (S-1-S-1-E), or finished to several other specifications. Rough-sawed lumber is considered to be of normal dimension if it measures full inches in thickness and width. Dressed lumber is a fraction of an inch smaller than rough lumber. For example, a dressed 1"x4" is actually 25/32" x 3 5/8" and a dressed 2"x6" is 1 5/8" x 5 5/8". Lumber is usually sold in lengths of 6' 0" to 20' 0".

3. Types and Patterns of Lumber

Transparency No. 1

- a. Common Boards: This lumber has square edges with different thicknesses, widths, and lengths.
- b. Standard Patterns: (1) Dressed and matched or tongue and groove is known as center-matched. (2) Off-center matched is a tongue and groove cut for flooring. (3) Shiplap is a board with a rabbet cut on each edge. (4) Beveled siding is a board planed at an angle from one edge to the other. (5) Car siding has a V-groove in the center and an angle cut on each edge of the grooved side. (6) Drop siding is a tongue and groove board that has a beveled cut on tongue side. (7) Crib siding is beveled on each edge.
- c. Board Lumber: This lumber is one inch or less in thickness.
- d. Dimension Lumber: This lumber is normally $1\frac{5}{8}$ " thick when dressed. It may be in 4", 6", 8", 10" and 12" widths.
- e. Plywood: Plywood is found in 4 feet widths and 8 to 12 feet lengths, with $\frac{1}{4}$ " to $\frac{3}{4}$ " thickness by units of $\frac{1}{8}$ ". There is exterior and interior plywood.
- f. Hardboard: This board is made of wood fibers. It is 4' in width and 4 to 12 feet in length. The most popular thicknesses are $\frac{1}{8}$ " and $\frac{1}{4}$ ".

4. Description of Plywood

Plywood is a built-up board made by assembling the veneers with the grain of each layer, or ply, at right angles to the ones adjacent to it. The kiln-dried veneer is united under high pressure with an adhesive producing a bond between layers as strong, or stronger, than the wood itself. An odd number of veneers---three, five, seven---is used so the grain direction on the face and back of the panel run in the same direction.

Wood is strong along the grain, but somewhat weaker across the grain. Cross-lamination distributes wood's along-the-grain strength in both directions, creating a panel that is very strong for its weight, split-proof and puncture-proof. Peeling veneers from a log and reassembling them also provides a means for making panels much larger than could be produced by sawing.

5. Types of Plywood

In general, "type" refers to the glue durability and bond that can be expected when plywood is used in various applications.

- (a) Exterior-type plywood has a waterproof glue and veneers selected for producing a bond between plies that is stronger than the wood itself. This type is the ultimate in moisture resistance as the glue cannot be weakened by time, weather, or even boiling water.
- (b) Interior-type plywood has either highly moisture-resistant or water-proof glue, at the option of the manufacturer. Veneers used in the inner plies and backs, however, are not as high quality as required for Exterior-type. It will withstand occasional wetting during construction, but should not be permanently exposed to the elements.

6. Grades of Plywood

- a. Plywood is graded by the appearance quality of the veneer on the face and back of the panel. There are six grades of veneer as follows:
 - "A" Best standard veneer. Smooth and paintable. May be more than one piece, well jointed. Neatly made repairs permitted.
 - "B" Solid surface veneer. Circular repair plugs and tight knots permitted. Can be painted.
 - "C-Plugged" Improved "C" Veneer. Underlayment grade.
 - "C" Minimum veneer permitted in Exterior-type. Knotholes to 1", splits, plugs, and other repairs permitted. (Occasional knotholes 1/2" larger permitted provided total width of all knots and knotholes within a specified section do not exceed certain limits.)
 - "D" Used only for inner plies and backs of Interior-type. Knotholes up to 2 1/2" in maximum dimension and an occasional knothole 1/2" larger under certain specified limits.
 - "N" Special order "natural finish" veneer. Select, all heartwood. Free from open defects. Allows some repairs.
- b. These veneer grades are combined to form the following plywood grades:

(SEE CHART NEXT PAGE)

EXTERIOR-TYPEINTERIOR-TYPE

<u>Grade</u>	<u>Face</u>	<u>Back</u>	<u>Inner Plies</u>	<u>Grade</u>	<u>Face</u>	<u>Back</u>	<u>Inner Plies</u>
A-A, Ext.	A	A	C	A-A, Int.	A	A	D
A-B, Ext.	A	B	C	A-B, Int.	A	B	D
A-C, Ext.	A	C	C	A-D, Int.	A	D	D
PlyForm, Class I & II,				B-B, Int.	B	B	D
B-B	B	B	C	B-D, Int.	B	D	D
B-C, Ext.	B	C	C	Int. Underlayment	C*	D	C & D
C-C, Ext. (plugged)	C*	C	C	C-D (plugged) Int.	C*	D	D
C-C, Ext.	C	C	C	Structural I C-D Int.	C	D	D
Structural I C-C Ext.	C	C	C	Structural II C-D Int.	C	D	D
				Standard Int.			
				(Exterior glue)	C	D	D
				Standard Int.	C	D	D

* C veneer that has been plugged.

Plywood is purchased by the sheet or square foot.

7. Calculating Board Feet

Transparency No. 2

Lumber prices are figured by the board foot for ordinary lumber. A board foot is the amount of lumber in a piece 1 inch thick, 1 foot wide, and 1 foot long.

Board feet may be calculated by using the board foot formula or the Essex board measure table on the carpenter's steel square.

- a. Board Foot Formula: If the lumber length is measured in feet; multiply the number of pieces times the thickness, times the width, times the length, and divide by 12. For example, to find the board feet in 5- 2"x4" - 12' 0": long, proceed as follows:

$$\frac{5 \times 2 \times 4 \times 12}{12} = 40 \text{ board feet}$$

If the length of lumber is given in inches, use the same procedure already used except divide by 144. For example, to find the board feet in 3-1"x6"-40" long, proceed as follows:

$$\frac{3 \times 1 \times 6 \times 40}{144} = 5 \text{ board feet}$$

8. The Importance and Meaning of a Bill of Materials

A bill of materials gives the number of pieces, dimensions of each piece, kind and amount of materials, and, in some cases, where the material is to be used. A list of materials for a farm pole building may include poles, lumber, concrete or gravel, metal roofing, nails, and hardware. Simply stated, a bill of materials is a list of materials which gives the amount, size, and kind to be used on a specific construction project.

How to Prepare a Bill of Materials

A working sketch usually contains a very simple set of specifications for a given job or project. If a large piece of equipment or a building is constructed or repaired, a set of specifications supplementing the drawing will give a bill of materials necessary for the job. The following procedure may be followed in preparing a bill of materials:

- a. Study the sketch or drawing (plan) of the building or piece of equipment.
- b. Develop a list of materials that will be used first and then make a detailed list needed for the job.
- c. Revise the detailed list by making a bill of materials in standard sizes. List the amount of the material for each stock, size, and give its description or use.
- d. Attach the list of materials to the sketch or drawing for future reference.

9. The Unit of Measure for Bill of Materials

- a. Board Foot - The board foot is a piece of lumber one foot long, one foot wide, and one inch thick. Most lumber is sold by the board foot or by the 1,000 board feet and grade classification.
- b. Running Foot - A running foot is a piece of material one foot long regardless of width and thickness. Molding, narrow finished lumber (1" x 2"), most pipe used in plumbing, electrical wire, fencing materials, molding materials, certain kinds of metal roofing, and certain types of reinforcement steel are sold by the running foot. A running foot measure is sometimes referred to as line of measure.
- c. Square Foot - A square foot is one foot long and one foot wide regardless of the thickness. Wall and floor tile, plywood and other paneling, concrete slabs, metal roofing, plastic materials, and floor covering (linoleums) are usually sold by the square foot. Some masonry materials are sold on the basis of covering a certain number of square feet.
- d. Cubic Foot - A cubic foot is one foot wide, one foot long, and one foot high. Cement and some other masonry materials are sold by the cubic foot.
- e. Cubic Yard - A cubic yard is 27 cubic feet. It is one yard (3 feet) on all sides. Sand, gravel, fill dirt, and concrete may be purchased by the cubic yard.

- f. Gallon - A gallon is a liquid measure. Paint and painting materials are usually sold by liquid measure. The weight of a gallon of paint is determined by its ingredients. A given quantity of paint is supposed to cover a certain number of square feet.
- g. Roll - A roll is something that is rolled into a cylinder or ball. Wire fencing, roofing paper, and certain types of roofing may be purchased by the roll.
- h. Square - A square is a term used in roofing. It is 10 feet by 10 feet, or 100 square feet. For example, three bundles of asphalt shingles will cover 100 square feet, and a square of metal roofing will cover 100 square feet.

10. Figuring A Bill of Materials
Transparencies No. 3 and No. 4

Bill of Materials for 12' Feed Trough

<u>Item Name</u>	<u>Material</u>	<u>Description</u>
Legs	1-2"x6"-12'	penta-treated pine
Floor	3-2"x10"-12'	S 4 S No. 2 yellow pine
Sides	2-2"x8"-12'	S 4 S No. 2 yellow pine
Ends	1-2"x10"-6'	S 4 S No. 2 yellow pine
Braces	1-2"x4"-10'	S 4 S No. 2 yellow pine
	2-2"x4"-12'	S 4 S No. 2 yellow pine
	1-2"x4"-6'	S 4 S No. 2 yellow pine
Nails	3 lbs.	16d common
Paint	1/4 gallon	Latex Barn Red

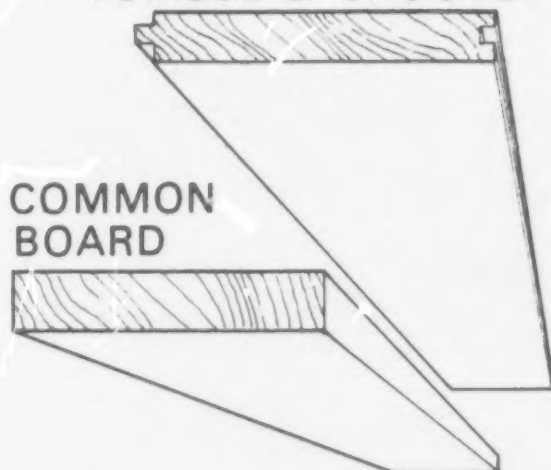
Lumber that is sold by the board foot is priced per M (1,000 board feet). For example, if 12 foot 2"x8" lumber is priced at \$375.00 per M, 1-2"x8"-12'0" piece of lumber would cost \$6.00.

$$\frac{1 \times 2 \times 8 \times 12}{12} = 16 \text{ board feet}$$

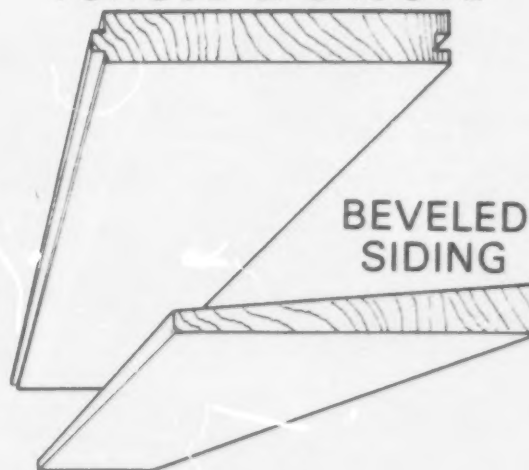
\$375.00 per thousand board feet or
\$.375 per board foot

$$16 \times \$0.375 = \$6.00$$

CENTER-MATCHED
TONGUE & GROOVE



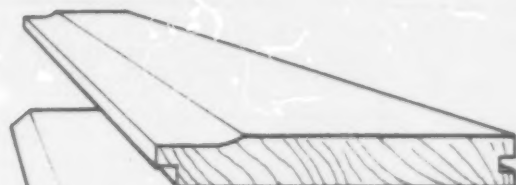
OFF-CENTER
TONGUE & GROOVE



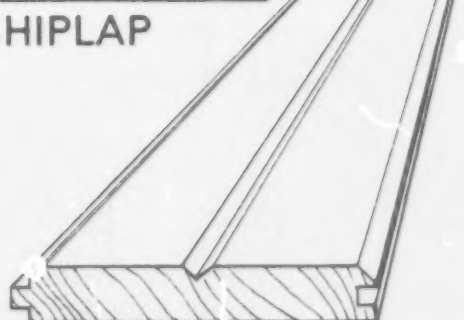
TYPES OF LUMBER



SHIPLAP



DROP SIDING
TONGUE & GROOVE



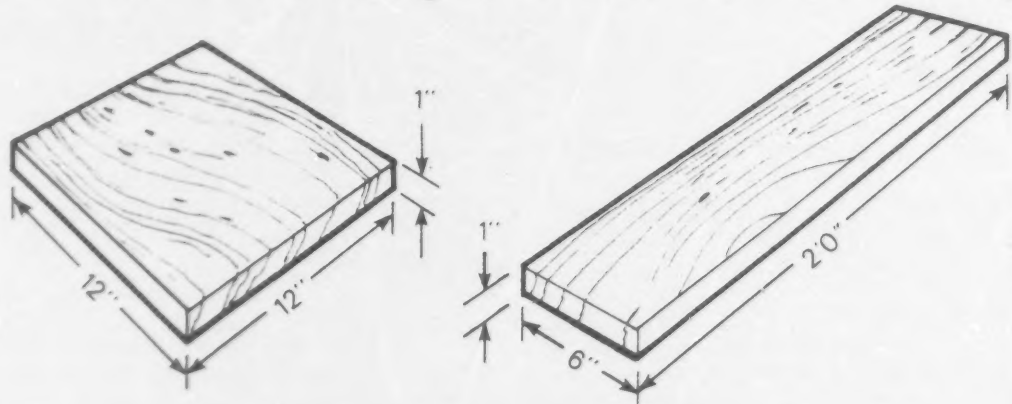
CAR SIDING



CRIB SIDING

1 Board Foot =

1 - 1"×12" - 1'0" long OR 1 - 1"×6" - 2'0" long



BOARD FOOT FORMULA

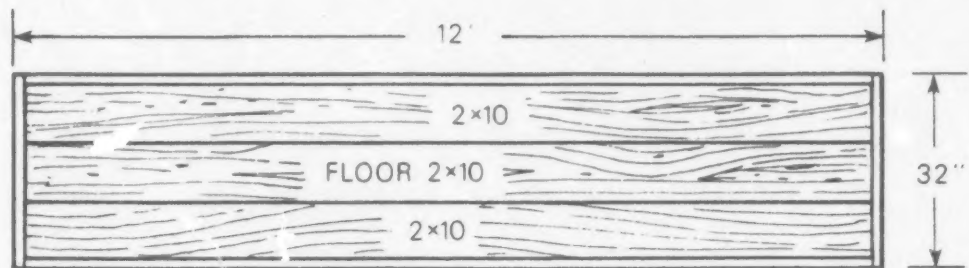
$$\frac{\text{No. of pieces} \times \text{thickness} \times \text{width} \times \text{length (in feet)}}{12} = \text{Board Feet}$$

EXAMPLE: Board feet in 5-2"×4"-12'0" long

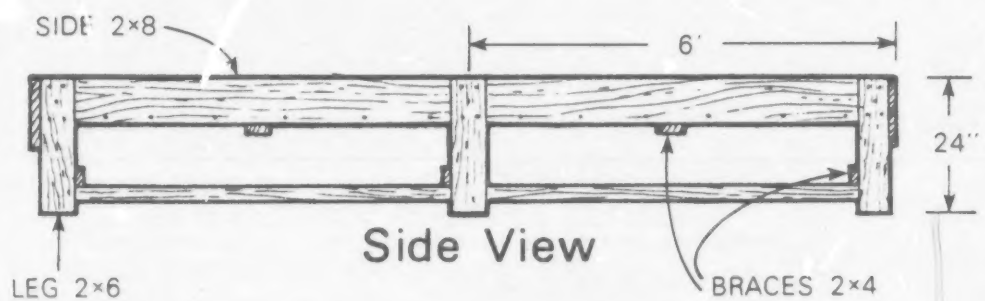
$$\frac{5 \times 2 \times 4 \times \cancel{12}}{\cancel{12}_1} = 40 \text{ Board Feet}$$

$$\text{OR } \frac{5 \times 2 \times 4 \times 12}{12} = \frac{360}{12} = 40 \text{ Board Feet}$$

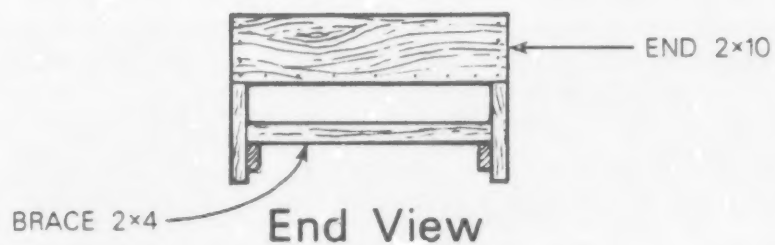
WORKING SKETCH-12 FOOT FEED TROUGH



Top View



Side View



End View

BILL OF MATERIALS -12 FOOT FEED TROUGH

<u>Item</u>	<u>Material and Description</u>	<u>Amount</u>	<u>Cost per M</u>	<u>Cost</u>
Legs	1 - 2" x 6" - 12' penta	12 bd. ft.	\$450.00	\$ 5.40
Floor	3 - 2" x 10" - 12' S4S No. 2	60 bd. ft.	375.00	22.50
Sides	2 - 2" x 8" - 12' S4S No. 2	32 bd. ft.	375.00	12.00
Ends	1 - 2" x 10" - 6' S4S No. 2	10 bd. ft.	375.00	3.75
Braces	{ 1 - 2" x 4" - 6' }	4 bd. ft.	320.00	1.28
	{ 1 - 2" x 4" - 10' }	7 bd. ft.	320.00	2.24
	{ 2 - 2" x 4" - 12' }	16 bd. ft.	320.00	5.12
Nails	16d common	3 lbs.	.50 per lb.	1.50
Paint	Latex Barn Red	1/4 gallon	10.00 per gal.	2.50
TOTAL				\$56.29

EXAMPLE COST CALCULATION

$$\text{(Legs)} \quad \frac{1 \times 2 \times 6 \times 12^1}{12_1} = 12 \text{ bd. ft.}$$

$$12 \text{ bd. ft.} \times 45\text{¢ per bd. ft.} = \$5.40$$

(\$450.00 per M)

MEASURING AND MARKING DEVICES

A. Measuring and Marking Devices for Agricultural Mechanics

Suggested Procedures and Activities: Measuring and marking tools displayed in the classroom may add interest to the class discussion.

1. Importance of Measuring and Marking Devices

Measuring and marking tools are some of the most important tools found in any agricultural mechanics program. Without proper measuring and marking devices, projects would lose much of their quality through the lack of good workmanship. Rules, tapes, squares, and other marking devices are just as important as any other woodworking hand tool, if properly used.

Standard linear measurements in woodworking are the foot, inch, and fraction of an inch. Measuring tools are usually divided into marking on one foot, one inch, one-half inch, one-fourth inch, one-eighth inch, and one-sixteenth inch. Carpenter's steel squares may be graduated by one-tenth and one-twelfth of an inch.

Area of square of a construction project is determined by the use of a measuring device. Materials are purchased according to units of measure from a measuring device, and in many cases, construction materials are sold by using a device to determine the size of the material needed. Lumber yards and hardware stores usually have measuring tools on hand for their local use in making sales.

Transparency Nos. 1 and 2

2. The Description and Use of the Common Types of Squares

a. Framing or Carpenter's Square

This square is L-shaped with a 24 inch long and 2 inch wide body and a 16 inch long and a 1 inch wide tongue. The blade and tongue arrangement forms a right angle. On most squares the inch is divided in several graduations.

The framing square may have the following tables on the tongue and blade: brace table, for laying out common braces; the rafter table, which gives the lengths of different types of rafters; the octagon table, for making eight-sided objects; and the Essex table, for determining the board feet.

Some Uses of the Framing Square are:

Boards are squared for cutting by placing the blade firmly against the edge of the board and marking against the tongue.

Another use is to lay out angles by observing a certain distance of the blade and the tongue as used for rafter cutting or making polygons and cutting at 45 degree angles. For example, using the same number on the blade and tongue (6 inch blade and 6 inch tongue), certain points on the edge of the board will give a 45 degree cut or angle. It also can be used for measuring length.

b. Try and Miter Square

The handle and blade form two angles, 90 and 45 degrees, the same angles as found on the combination square. The blade ranges from 6 to 12 inches in length.

c. Try Square

The try square most commonly used is a six inch blade. The handle is not used for measuring. The blade is graduated into one inch, one-half inch, one-fourth inch, and one-eighth inch. Actually the blade length may vary from 6 to 12 inches.

It is used mainly to test the squareness or accuracy of cut. This square may also be used for short measurements and laying out lines across the face of a board from the edge. The try square is similar to the framing square in that the handle and blade form a 90 degree angle.

d. Combination Square

The combination square consists of a face and head. The head is equipped with a spirit level. The blade is of several different lengths, but the 12 inch blade is most commonly used. The common head has a 90 and 45 degree angle to the blade. It is attached to the blade by a slot in the blade's center. The head can be moved up or down on the blade. It is graduated from one inch to one-sixteenth inch.

The square can be used as a marking gauge, straight edge, try square, level, depth gauge, plumb, or mitre square. With a center head attachment, it can be used to locate the center of round objects. With a bevel-protractor head, angles can be marked in degrees. The blade can be used for measuring short lengths.

e. T-Bevel Square

The most common type has a six inch blade with a 45 degree beveled end. The blade has a long center slot which permits its movement to form a T-bevel or angles. It is usually not graduated.

The main purpose of the T-bevel square is to transfer angles, bevels, and chamfers from one stock to another. It can be set at any angle by tightening the blade screw; therefore, several boards can be cut at the same angle.

Transparency No. 3

3. The Description and Use of the Common Types of Rules

a. Zigzag or Spring-Joint Folding Rules

The zigzag rule is usually six feet in length. It is graduated from one inch to one-sixteenth inch and can be read both ways, from left to right and right to left. Some of the more expensive rules have a six inch extension which permits making inside measurements of objects such as door and window facings.

Long measurements may be made with the zigzag rule. It folds every six inches and should be handled with care while folding, due to its being thin and long. The framing square is used to square a board after the rule has been used. Another way to use the rule on boards over 12 feet is to unfold the rule completely, mark off six feet from each end, then mark the center between the two six feet points.

b. Two-Foot Folding Rule

This short folding rule is two feet or 24 inches long, and one-half inch wide. It can be folded down to the length of the zigzag rule, six inches, but it is easier to handle because of only four folds. The graduation lines are the same as those found on the zigzag rule. The long line is one inch, followed by one-half, one-fourth, one-eighth, and one-sixteenth inch.

The two-foot folding rule is used to measure short pieces of boards or short objects. If several short marks are to be made on a stock, it is advisable to turn the rule on its edge, so that the ruled lines touch the stock and make the marks without changing the rule.

c. Bench Rule

The bench or one piece rule is non-folding. It is 24 inches long and 1½ inches wide. It is graduated in sixteenths of an inch on one side and eighths of an inch on the other side.

The rule is similar manner as the short folding rule. The rule is used on its edge for a distance of less than two feet. It is one-

fourth inch thick; therefore, edge measurements can be made without difficulty. The rule can be used as a straight edge.

d. Push and Pull Rule

The push and pull rule is similar to a tape in that it rolls inside a round metal case. The metal rule is available in many lengths. The most commonly used length is 10 feet. It is graduated in inches. Only one side of the rule is numbered; but both edges of the numbered side are graduated in sixteenths of an inch. Some rules are graduated for the first few inches in thirty-seconds of an inch. Several types of pull-push rules are equipped with a rewind mechanism.

The push and pull rule is for measuring layout work of both short and long objects. The size of the rule permits it to be carried in the pocket. Curved or irregular surfaces may be measured by this metal rule due to its flexibility. When making inside measurements, the 2 inch metal cast is added to the measurement.

e. Caliper Rule

This rule is used mainly to measure the thickness of materials by taking measurements between the jaws of the rule. Holes and width of cuts can be made by inserting the jaws and reading the inside measurement.

Transparency No. 3

4. Identification and Use of Tapes

a. The Steel Tape

Steel tapes are found in standard lengths of 25, 50, and 100 feet. The tapes are graduated in feet, inches, and usually to one-eighths of an inch.

Tapes are used to make long measurements, and only one person can use the tape effectively if the ring at the end or starting point is hooked in place by a nail or other holding device. The tape is used on foundations, drive layouts, and many landscaping jobs.

b. The Cloth Tape

This tape is found in the same sizes and graduations as the steel tape, 25, 50, and 100 feet being the most common lengths.

The cloth tape can be used in the same manner as the steel tape. It may have a tendency to stretch, but it will not kink, which may be a common problem with the steel tape if it is not used properly. On the steel and cloth tapes, with rings at the end, measurements are

read from the tip of the ring.

Transparency No. 4

5. Marking and Reading Devices

- a. Marking Gauge- The marking gauge is used to make parallel lines from either the edge, side, or end of a board. The setting of the gauge is made by the use of a rule. A reading is taken from the spur to the gauge head by a rule. It is necessary that the gauge head be pushed forward against the stock so that the spur moves at a slight angle.

- b. Other Marking Devices

The combination square serves as a marking gauge by placing the head against the surface of the stock and adjusting the blade to the desired distance. A pencil or sharp, pointed instrument is placed at the end of the blade as it is moved by a pulling motion. Both hands are used to handle the square and pencil.

When using a rule or straight edge, the thumb or finger regulates the distance to project the end of the rule over the board for marking. A pencil or sharp-edged instrument is used at the end of the rule to make a mark as it is pulled forward. Both hands are needed to manipulate the rule and pencil; therefore, the stock should hold firmly by some means, permitting the hands to be free for marking.

When using the thumb or finger as a guide and using only a pencil for marking, it is necessary that the starting point be measured by a rule. This method is less accurate than the use of a marking gauge or a combination square.

Dividers are a device used for making circles, transferring short measurements from a rule, and dividing measurements into equal parts.

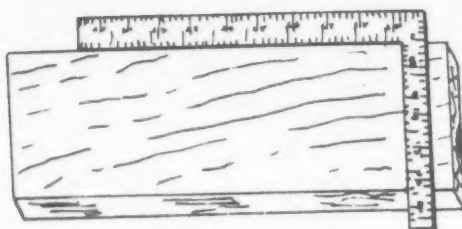
Either rules or squares of different types may be used to find the center or even parts on the board. For example, to find the center of a board that is 5-5/8 inches, the 2 inch mark of a rule can be placed on one edge and the 8 inch mark placed on the other edge. The rule will be at an angle on the board, but a mark at five on the rule will be the center. Marks at four and six on the rule will divide the board into three equal parts. Odd numbers can be determined by dividing the number by the desired number of pieces.

Inside measurements may be made by using the extension of the six foot folding rule by

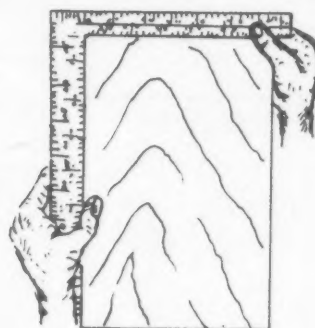
placing two bench rules together if the distance is between two and four feet and then taking the overlap readings, or by using two pieces of boards, each end touching the inside of the object (door or window facing) and marking the end of each where they overlap. The distance may be transferred to a rule for making a correct measurement.

The most common marking devices include pencils, knives, awls, and chalk lines. In some cases narrow wood chisels have been used.

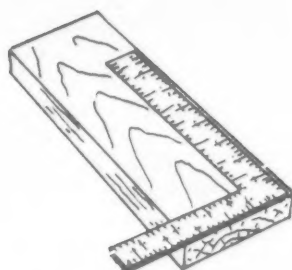
USE OF THE FRAMING SQUARE



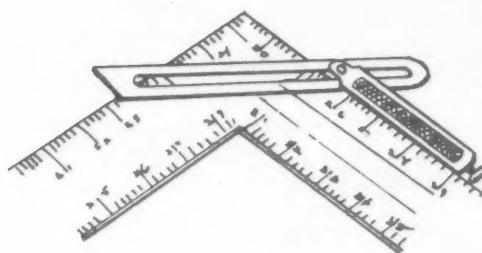
squaring board



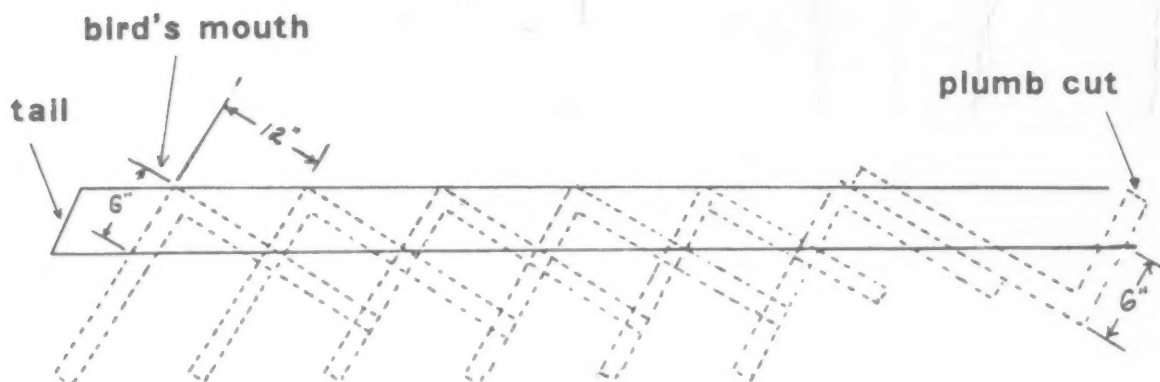
testing board



measuring board

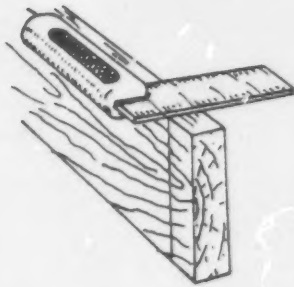


setting T-bevel

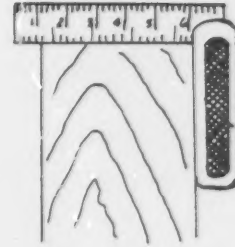


LAYING OUT COMMON RAFTER

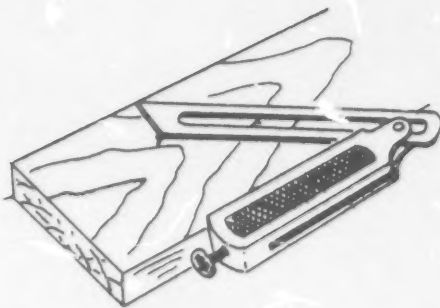
USE OF SQUARES



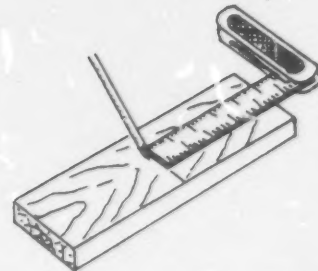
try square edge squaring



try square testing cut



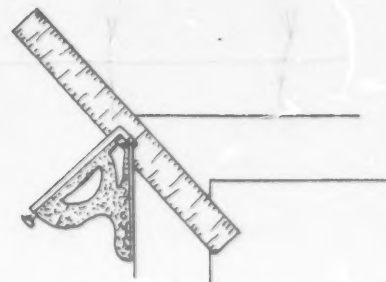
T-bevel marking angle



try square measuring



**combination
marking board**



**combination testing
45 degree angle**

RULES, TAPE AND MARKING GAUGE



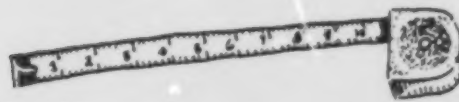
zig zag rule



two-foot
folding rule



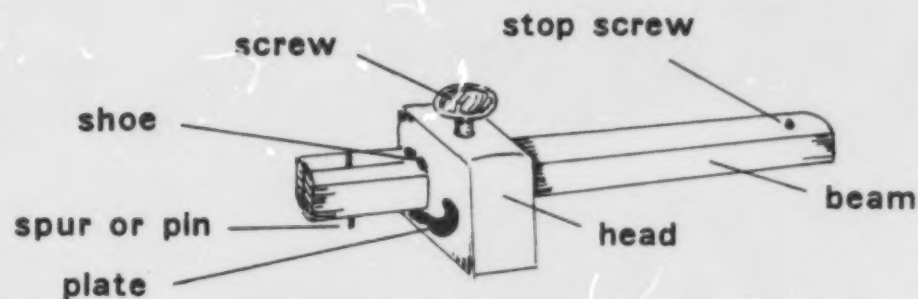
bench rule



push - pull rule



tape



marking gauge

BOLTING, RIVETING, AND REMOVING BROKEN BOLTS

The types, sizes, parts, and use of five commonly used bolts in agricultural mechanics are listed in V-B-8, "Identification and Use of Nails, Screws, Bolts, and Other Fasteners".

The major purpose of using bolts is to fasten metal to metal or metal to other types of materials. Some of the many reasons why bolts are used on agriculture machinery are as follows:

- To give strength or permanency to metal parts or objects.
- To make the dismantling of a metal structure simple and easy.
- To fasten covers that conceal engine or motor parts that may need repairing occasionally.
- To make adjustments on machinery so that the machine will operate properly.
- To reduce the cost of cutting and welding machine parts on repair and inspection jobs.
- To simplify the manufacturing of machine parts. Certain assemblies and components must be made into several parts or pieces.

Bolts must have the same qualities as found in other materials. That is, they must be made of good metal, be long lasting, strong, corrosion resistant, reusable, temperature resistant, capable of withstanding vibration, and in most instances easy to remove. Bolts are classified according to grades by the Society of Automotive Engineers (SAE). The grades are determined by the material in a bolt and the treatments of the tensile strength (TS) (pull withstood by a bolt without breaching or being distorted). SAE markings (slashes) on the head of the bolt identify grade markings and strength. Examples are:

SAE grade 0,1,2



TS to 69,000 psi,min.

SAE grade 5



120,000 psi,min.

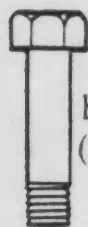
SAE grade 8



150,000 psi,min

1. Types of Bolt Heads

There are several different types of bolt heads found in each class of bolts. Each type of head is especially made for a certain function. For example, a hexagon or square head bolt is used where the parts of a machine may be disassembled frequently. The shoulder of the carriage bolt is pulled into the wood, and this prevents it from turning. A flat head carriage bolt is pulled into the wood, and this prevents it from turning. A flat head is flush with the surface. The large flat or tapered head carriage bolt (elevator bolt) is used in the same manner as the

hexagon
(square)

standard flathead bolt, but the head covers a larger surface.



round

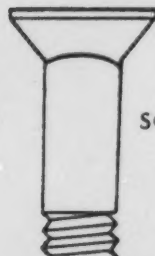
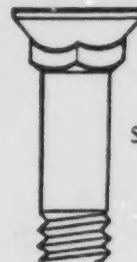


carriage



flat (tapered)

There are three major types of plow bolt heads. Each bolt is made for a specific purpose. These types of bolts were originally developed to attach the plow share to the moldboard. They are used to fasten the cutting blade on several different types of dirt moving and shaping equipment. These bolts are made with three different types of tapered flat heads. All are made to countersink into the metal, causing the head to be flush with the surface. The different types of heads are listed below:

square head
plowsquare shoulder
plow

Hex socket head bolts are found on farm machinery where it is necessary that the head be sunken, recessed, or located in a confined space. The hex hole in the head is made to accept a hex (Allen) wrench.



hex socket head

Twelve-point head bolts are used in locations where a small head is needed. In other words, it is used similarly to the hex socket head bolt. They can be turned with a double hex socket or by gripping the external teeth around the head. This type of fastener is known as a high-strength bolt.



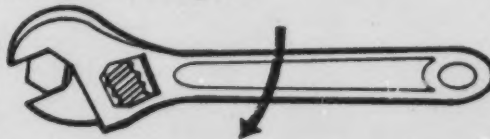
twelve point head

2. Some Different Kinds of Wrenches for Bolts and Their Uses

Wrenches are very essential tools for use on farm machinery setting-up, adjusting, and maintenance jobs. The many different types of wrenches are made to install and remove nuts and bolts quickly and easily.

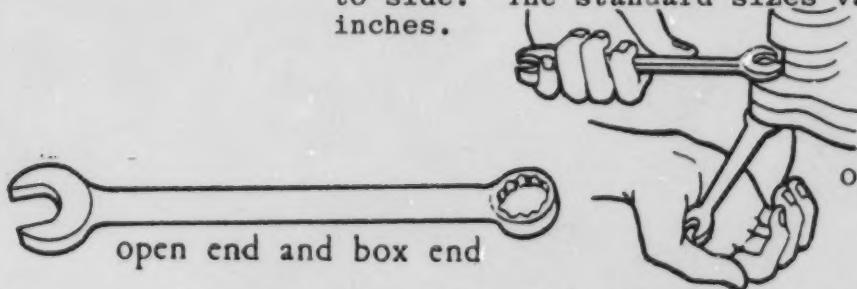
Common Wrenches and Their Uses

- a. **Adjustable Wrenches** - The adjustable wrench must fit snug on the bolt to be turned or the head of the bolt to be held. A properly adjusted wrench will not round the corners of the nut or bolt or damage the jaws of the wrench. Pressure is usually applied on the side having the fixed jaw. Only moderate pressure should be used if the wrench is used on the other side. The angle of the head of the wrench gives it an added advantage for "flopping" the wrench in cramped quarters. The sizes of these wrenches vary from 4 to 24 inches in length.



adjustable
wrench

- b. **Open End Wrenches** - These wrenches are made to fit the nut or head of the bolt snugly. They can be pulled in either direction, but pressure is usually applied on the longer jaw side. The head is set at an angle which makes it usable in close places if the wrench is turned from side to side. The standard sizes vary from $\frac{1}{4}$ to $1\frac{1}{2}$ inches.

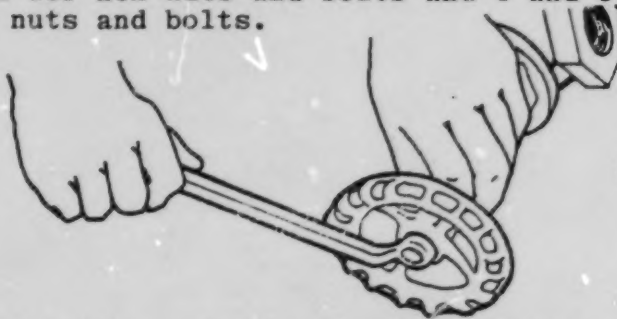


open end and box end

open end wrench

- c. **Combination Open-End and Box End Wrenches**- The box end of this wrench usually has 12 points. It is designed to tighten and break loose hexagon shaped nuts and bolts. Four- and 8-point box ends can be used on square nuts and bolts. The box end completely surrounds the nut or bolt head, making a firmer grip than is made by the open end part of this wrench.
- d. **Box Wrenches**- These wrenches are used mainly to break loose or snug down a nut. They usually cannot be operated as fast as an open end wrench.

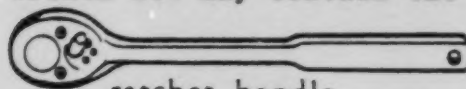
Some obstructions require that the wrench handle be off-set or angled sharply; therefore, an off-set box end is necessary to do bolt work. Box wrenches have a ring type opening on both ends of the handle. The number of points are usually 6 or 12 for hex nuts and bolts and 4 and 8 for square nuts and bolts.



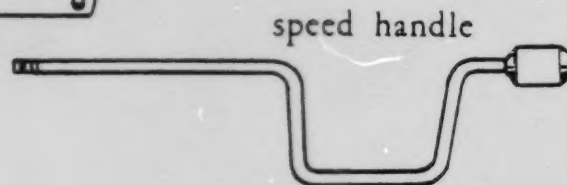
- e. Socket Wrenches - Socket wrenches continue to be the most popular type of hand tool in agricultural mechanics shops. They cause the work to be much easier and faster. A socket wrench set consists of sockets, ratchet handle, speed handle, sliding handle, extensions, and universal joints. Some sets are equipped with a flex handle. A socket wrench set may contain the following:



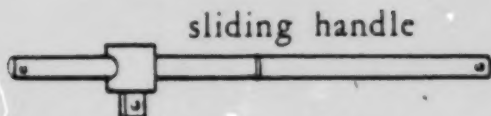
socket
(several types and sizes)



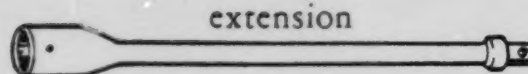
ratchet handle



speed handle

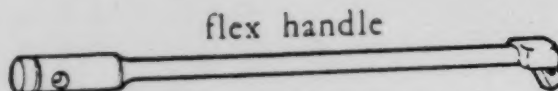


sliding handle



extension

universal joint



flex handle

The different types of handles all serve special purposes. For example, the most widely used handle is the ratchet. It is used to tighten or loosen nuts without removing the socket or freeing it from the nut. Ratcheting permits the handle to be pulled and ratcheted back to the same position for another pull. Speed handles are used for fast installation or removal of loose nuts. It is not necessarily used for tightening. The flex and sliding handles can be used for tightening nuts. The ratchet handle allows nuts to be tightened in close places, whereas a large area is needed for a flex handle. Socket set universal joints are used where it is necessary to turn a handle at an angle. Commonly used drives are equipped with square lugs that are either $\frac{1}{4}$,

3/8, 1/2 or 3/4 inch. The sizes 3/8 and 1/2 inch are most often used. Heavy duty handles may have lugs 1 inch and 1 1/2 inch.

There are three commonly used sockets. The double hex, single hex, and double square sockets are used on most machine repair jobs. The double hex socket slips on and off the nut more easily than a single hex; therefore, it is more widely used. The same is true when using a double square socket. Also, double-point sockets give a more desirable angle for turning. The top end of a socket has a square hole for inserting the lug of connecting the handle to the socket. Long or deep sockets are used to remove or replace spark plugs and for work with nuts that are tightened a long way down on bolts.

double hex



double square



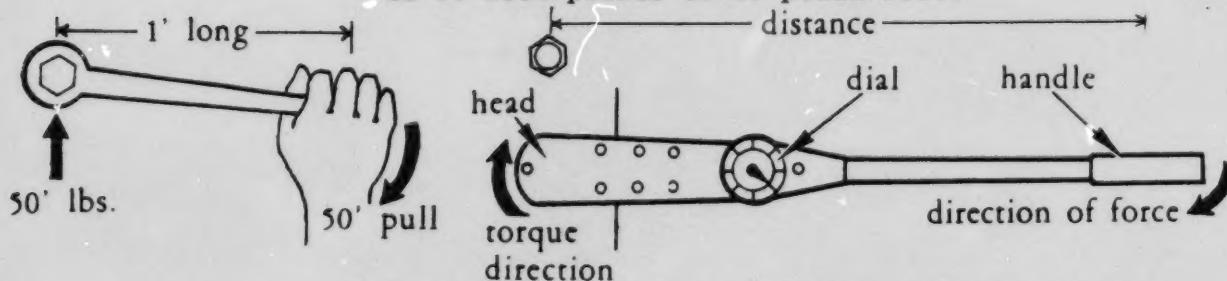
single hex



square



- f. **Torque Wrenches** - The only way to get recommended torque is to measure it by using a torque wrench. The main purpose of these wrenches is to tighten bolts, set screws, and machine screws the right amount. A properly torqued bolt has the right amount of tension to remain tight and do the job. Torque is usually measured in inch-and foot-pounds in the mechanics shop. It is actually measuring the twist pressure that is applied at a certain distance from the center of the bolt being twisted. For example, when using a wrench 1 foot long and applying a pulling force of 50 pounds, the torque is 50 foot-pounds or 50 pound-feet.

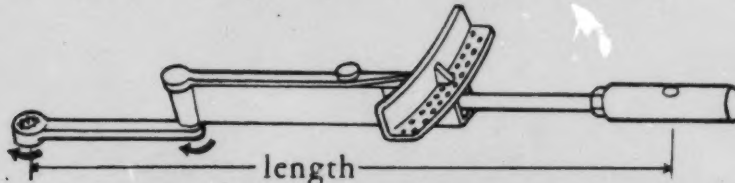


Inch-pounds may be converted to foot-pounds by dividing by 12:

$$\frac{\text{Inch-Pounds}}{12} = \text{Foot Pounds} \quad \text{and} \quad \frac{\text{Foot-Pounds}}{12} = \text{Inch Pounds}$$

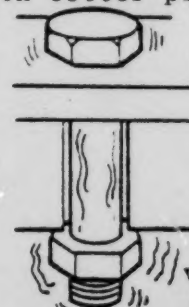
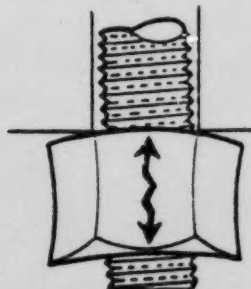
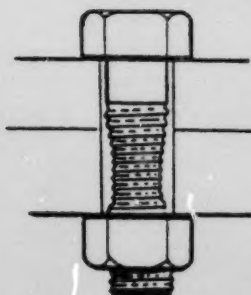
There are several types of adapters made for torque

wrench use. If the adapter fits on the drive square just below the torque wrench head, and force is applied at this point (directly in line with the head), the length of the wrench is not increased and the reading is the same as without the adapter; but any wrench extension that increases the length is figured into the effective length of the overall wrench.



3. The Use of Bolts in Joining Metal Together or Joining Metal with Other Materials.

- a. Center punch the top piece of metal at the point where the metal is marked (+) with a scratch awl.
- b. Select the proper size of twist drill to make a hole for the bolt. If the hole is too small, a long-tapered reamer may be used to enlarge it.
- c. Use the following methods to drill holes in pieces of metal that are to be joined together:
 - (1) Clamp one or more pieces of metal together and drill all aligned bolt holes at the same time.
 - (2) Mark the two pieces of metal separately and drill the holes separately; then place a bolt in the two drilled holes to hold the metal in a firm position for drilling the remaining holes.
- d. Draw the nuts tightly when bolting metal together. Proper pressure on a nut will not damage the threads or stretch the bolt, but excessive twisting pressure will lengthen a bolt, deform the nut, and possibly cause the bolt to twist or turn in the hole. On the other hand, if the bolt is not properly tightened, it may work loose and may be sheared or cut by metal movement. These are some of the reasons why torque wrenches are used to tighten bolts on most machinery and why slotted and castle nuts are used with cotter pins.



castle nut
with cotter
pin

- e. Secure bolts on vibrating machinery with lock washers fitted under the nut. When metal is attached to wood, flat washers may be used between the bolt head or nut and the wood surface. A wing nut is used where tightening pressure can be accomplished by the thumb and finger. Lock washers are usually not used with wing nuts.



lock washer



flat washer

- f. Use the proper size and type of wrench on bolt heads and nuts. For example, open end wrenches are used on either the square head or hexagon head bolts and nuts. Adjustable wrenches are also considered good square nut wrenches. A socket or box end wrench is thought of as a hexagon bolt wrench. Pipe wrenches and pliers are not made to use on square or hexagon bolts or nuts. Pipe wrenches can be used on pipe or round rods.



- g. Steps to consider when using torque wrench to tighten bolts are as follows:

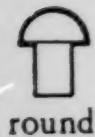
- (1) Make smooth steady pulls to prevent over-torqueing.
- (2) Before torqueing bolts, clean dirty holes, bolts, and nuts.
- (3) Damage or blocked threads may give a false reading on the torque wrench. Extra torque may be used to pass over these areas.
- (4) When tightening a bolt and a popping sound occurs, loosen the bolt or nut and retighten. Make a steady pull or turn with the wrench and at the same time take the torque reading.
- (5) Lubricate bolts and nuts or bolt holes very sparingly. A hydraulic lock may occur if a bolt hole contains too much oil.
- (6) Use torque tables when necessary. The table will give the outside diameter or body size and foot-pounds and inch-pounds tightening values of lubricated bolts and nuts.

4. Riveting Metal

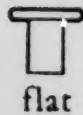
Some of the reasons why rivets are used to join and hold metal parts in a permanent position are:

thin metals can be joined together at a low cost, rivets are easily installed, and they are considered versatile. Also, rivets are used to fasten nonmetallic materials together such as plastic, leather, canvas, and fiber material. Rivets used on agricultural machinery are made of metal, and they may be classed as metal pins that resemble bolts except that they are threadless and one end is shaped by a machine or hammer.

- a. There are many different kinds of rivet heads, but the most commonly used are:



round



flat



countersunk



truss



cone



steeple

The use of a rivet may also determine its body structure. The body may be tubular, split, solid, or blind type.



tubular



split



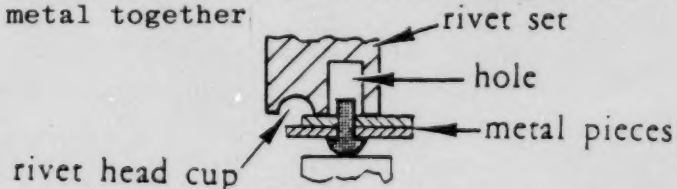
solid



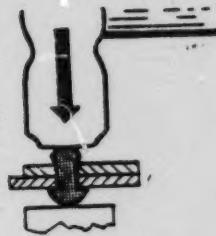
blind types

- b. The steps that may be used in riveting metal include:

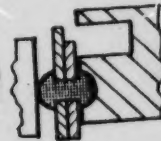
- (1) Mark (+) the center of rivet holes on the metal and an awl, and center punch the hole location.
- (2) Use a twist drill the size of the rivet to make the hole.
- (3) Countersink the hole if countersunk rivets are to be used.
- (4) If the rivet is too long, cut it $1/16$ to $1/8$ inch above the metal surface. Before the rivet is cut, use a rivet set (hole over rivet) to draw the pieces of metal together.



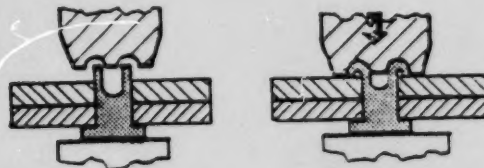
- (5) Make first few hammer blows straight down on the rivet to bulge the head. It may be necessary to peen the head that is formed from the shank or body of the rivet before using the set.



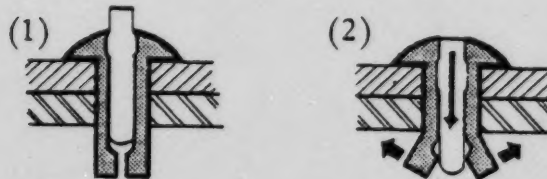
- (6) Use the rivet set to "buck" or shape the head solid against the metal.



- (7) Set tubular and split rivets with special rivet sets. The tool (rivet set) is used to spread the sides of the rivet and draw the rivet edges down firm on the metal.



- (8) Blind rivets are used where only one side of the joint is accessible. Most blind rivets have a hollow core for a pin. However, there is one type with an explosive core that spreads after it is seated in a hole. To fasten the drive-pin type of rivet, drive the pin to a depth to spread the rivet.



5. Removing Broken Bolts

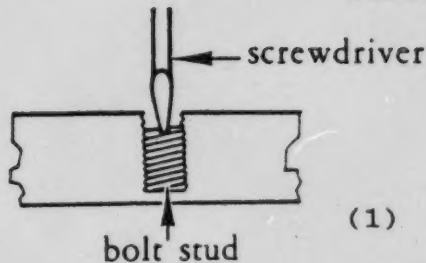
- a. Many agricultural mechanics shops are not supplied with the various types and sizes of bolt extracting equipment that is necessary to remove any kind and size of bolt. Most bolts break at the surface of the hole, thus eliminating the use of any type of pliers or wrenches to extract the part left in the hole.

Equipment that may be used to remove bolts is as follows:

Hand drill and drill bits
Standard cold chisel, diamond point
and round-nose chisels
Ball peen or blacksmith's hammer
Starting, center, and peen punches
Adjustable and tap wrenches
Hacksaw and screwdrivers

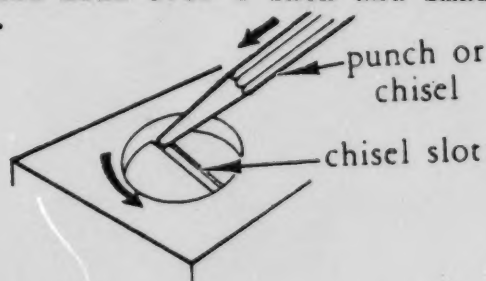
- b. There are several methods used to remove broken bolts, and some of the most popular methods are:

Screwdriver - Steps in using the screwdriver are:



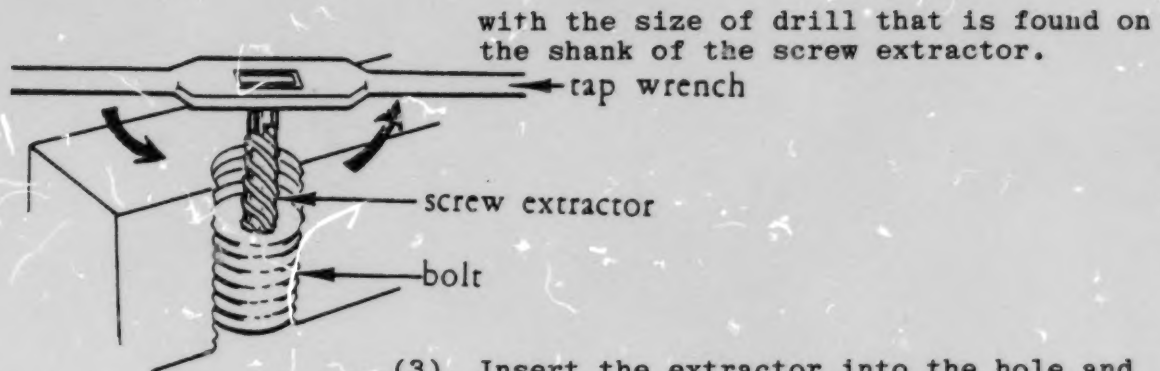
- (1) Saw a slot across the broken bolt or cut a slot in the end with a cold chisel. It may be necessary to cut into the base metal to make the slot deep enough for a screwdriver.
- (2) Back the broken bolt out by using a screwdriver.

Punch and Chisel - If the screwdriver fails to bread the bolt loose, a round nose punch or a flat chisel can be used by placing either the punch or chisel on one side of the end of the stud (bolt) and tapping lightly. This method may not be considered the best way to remove very large or very small bolts. Large could mean over 1 inch and small under 1/4 inch.



Screw Extractor - If the bolt is too tight to be backed out of the hole with a screwdriver, chisel, or punch, then it may be necessary to use an "Ezy-Out" or extractor. An extractor is made of hardened steel with left-handed spirals. Steps to follow in using the extractor are:

- (1) Dent the center of the broken bolt with a center punch.
- (2) Drill a pilot hole into the center of the bolt, then follow the pilot drill



- (3) Insert the extractor into the hole and turn counterclockwise to loosen the broken bolt or stud. A tap wrench or adjustable wrench may be used on the fluted end of the extractor.



Other Methods - Other ways to extract broken bolts are:

A hole is drilled in the stud (broken bolt) in the same way as drilling a hole to insert a screw extractor, except that the hole may be larger in diameter and deeper. A diamond point chisel is tapped lightly into the hole and the stud is backed out by using an adjustable wrench on the chisel body.

A large hole is drilled in the stud by following the steps for drilling a hole to accommodate a screw extractor. The stud wall is left thin so that it may be pushed in with a chisel or punch. A flat instrument (screwdriver, etc.) may be used to force the stud out by turning it.

The broken bolt may be drilled completely out and the hole retapped for a larger bolt. If the broken bolt is large (over $\frac{1}{2}$ an inch) the hole may be drilled with three different sizes of drills including the pilot twist drill, in order to make the drilling easier.

Heat causes metal to expand and cold causes it to shrink. Heat also causes rust and other foreign materials to break loose from the metal. After a broken bolt is heated and cooled it may be easier to remove with a screwdriver, punch, chisel, or extractor.

Sizes of Drills and Extractors to Use

Twist Drill Inches	Size of Bolt Inches	Extractor Size No.
5/64	3/16 - 1/4	1
7/64	1/4 - 5/16	2
5/32	5/16 - 7/16	3
1/4	7/16 - 9/16	4
1-1/16	1-3/8 - 1-3/4	8
1-3/16	1-3/4 - 2-1/8	9
1-5/16	2-1/8 - 2-1/2	10
1-9/16	2-1/2 - 3	11

General -

Protruding broken bolts may be removed by welding nuts on them and backing them out with a wrench.

The use of penetrating oil may aid the extraction of broken studs, especially if the studs are rusty.

If the threads inside a hole have been damaged, it may be necessary to retap the hole before using it.

Screw extractors are easily broken if too much pressure is applied while backing out a broken stud. If an extractor breaks, it may be necessary to remove it with a cold chisel or punch by breaking it into small pieces.

SUGGESTED STUDENT ACTIVITIES

1. List five reasons why bolts are used on agricultural machinery,
 - a.
 - b.
 - c.
 - d.
 - e.
2. What are the qualities of a good bolt?
3. Explain the meaning of the marks or slashes on a bolt head.
4. Sketch (draw) the head of the following bolts:
 - a. Square head plow bolt
 - b. Hexagon head machine bolt
 - c. Carriage bolt
 - d. Key head plow bolt
5. Completion
 - a. Pressure is usually applied on the side of the adjustable wrench handle having the _____ jaw.
 - b. Open end wrenches are made to fit the nut or bolt head _____

Completion (Continued)

- c. _____ wrenches cannot be operated as fast as open end wrenches.
 - d. _____ wrenches are considered most popular of all wrenches in the machine shop.
 - e. When using a _____ handle the socket does not have to be removed from the nut.
 - f. Flex handles are used to _____ and _____ bolts and nuts.
 - g. The proper amount of tension can be applied to a bolt when using a _____ wrench.
 - h. Thin or sheet metal can be fastened together by using _____
 - i. _____ rivets are used where only one side of the joint is accessible.
 - j. _____ are used to remove bolts or studs.
6. Place a T beside the True statements and an F beside the False statement:
- _____ 1. The use of bolts simplifies the manufacturing of many machine parts.
 - _____ 2. The material (type metal) in a bolt and the treatment or use are factors in determining bolt grades.
 - _____ 3. Bolt grades are identified by markings or slashes found on the threaded end.
 - _____ 4. A carriage bolt has either a hexagon or square head.
 - _____ 5. Plow bolts are used only to attach the plow shares to the moldboard part of a plow.
 - _____ 6. Pressure is applied to the handle of an adjustable wrench on the adjustable jaw side.
 - _____ 7. An open end wrench can usually be used more rapidly than a box end wrench.
 - _____ 8. The socket wrench is considered to be the most popular type of wrench in the shop.
 - _____ 9. Speed handles are the most commonly used handles in a socket wrench set.
 - _____ 10. A double hex socket is usually more easily used than any other type of socket.
 - _____ 11. When using a torque wrench, it is difficult to convert inch-pounds to foot-pounds.

- ☐ 12. Bolts are usually stretched when tightened.
- ☐ 13. Adjustable wrenches are not considered good square nut wrenches.
- ☐ 14. Bolts cannot be over torqued or tightened too much with a torque wrench.
- ☐ 15. Rivets are not considered a versatile type fastener.
- ☐ 16. A rivet that is too long should be cut before it is set.
- ☐ 17. A ball peen hammer is considered a good rivet tool.
- ☐ 18. Most screw extractors can be turned with either a tap wrench or an adjustable wrench.
- ☐ 19. An extractor is inserted into a drilled hole in the bolt by turning it clockwise.
- ☐ 20. Heat causes metal to shrink, and cold causes it to expand.

7. Briefly discuss the following questions:

- a. Discuss how rivets are used on agricultural machinery.
- b. List by steps the joining of two pieces of metal together by using rivets.
- c. Discuss the proper use of an adjustable wrench.

- d. What is the purpose of a torque wrench? How is torque measured?
- e. List the steps to consider when using a torque wrench.
- f. What steps should be followed when removing a bolt with a screw extractor?
- g. How is a punch or chisel used to remove bolts?

References

1. Student Manual - Texas A&M University

SOLDERING FOR HOME, FARM, AND SHOP APPLICATIONS

1. Soldering and Other Metal Joining Processes
2. Tin-Lead Solders
3. Soldering Flux
4. Sources of Heat for Soldering
5. Soldering Procedure
6. Maintaining Soldering Irons (Coppers)
7. Silver Soldering
8. Installing Sweat-Type Fittings
9. Soldering Stainless Steel and Aluminum
10. Safety Hazards Connected with Soldering
11. Shop and Laboratory Applications

Soldering is a process that is ages old but its importance continues to increase in modern times. Soldering as a means of joining metals may have been known to the Egyptians when they were building the pyramids. The Romans used solder in metal working at the beginning of the Christian era. In modern times it is hard to imagine how life would be without the many uses of solder.

The importance of solder in our everyday life can hardly be overemphasized. It is used in electrical appliances, automobiles, air conditioners, plumbing, food containers, and communications equipment, such as radio, telephone, and television. The economic importance of soldering can be illustrated by the fact that the annual consumption of solder in the United States has exceeded 100,000 tons annually, since 1956. The automotive industry uses about 45% of the total for body work and radiator assembly. The manufacture of cans uses about 20% of the total solder used.

Much attention has been given to the chemical and physical processes involved in soldering but the role of good workmanship has often been ignored. Soldering is being replaced by pressure connectors for certain jobs in electrical wiring partly because of the difficulty of getting workmen to make reliable soldered connections.

Many items of equipment and appliances can be quickly and economically repaired at home if the basic principles of soldering are understood. Industrial and governmental jobs in the electrical, communications, missile, and space industries have elevated soldering technology to a higher level of importance than it has enjoyed in recent years.

1. Soldering And Other Metal Joining Processes

Soldering

Soldering alloys include a large number of alloying elements, but they are used in a process of joining metals below 800° F. Soft solder is a fusible alloy, consisting primarily of tin and lead, used to join metals together at temperatures below their melting point. Other metals present in soft solders, in addition to tin and lead, are antimony, bismuth, cadmium, silver, indium, and zinc. These metals are added to vary the physical or chemical properties of the alloy. Soft solder is used to fasten such common metals as tin, copper, steel, or brass and is an economical and reliable means of joining metals without fusion of the base metal. The term "solder" used here should not be confused with liquid solders and cold solders, which are really a form of cement or glue.

Brazing

Brazing is a process where metals are joined at temperatures above 800° F. Hard solder or brazing alloys are often used where the filler metal flows into the joint by capillary attraction. Brazing alloys include such metals as copper, gold, magnesium, aluminum, and nickel.

Welding

Welding is a process of joining metals at temperatures high enough to melt the base metal. The process is familiar to us as arc welding, oxyacetylene welding, inert gas shielded-arc welding, or spot welding.

The soldering process

Soft solders get their holding power from an inter-metallic solution action. The solder dissolves a small amount of the surface of the base metal at a temperature for below the melting point of the base metal. Since this dissolving of the metal is a metallurgical action between the solder and the metal being joined, it is apparent that the soldered connection is chemical in nature as well as a physical union. This would indicate that the properties of the solder in the joint are different from those of the original solder.

A soldered joint or connection has continuous metal continuity while a plain lock seam or a twisted wire connection does not. When two pieces of metal are soldered together, they expand, contract, heat, cool, and in general behave like one piece of metal, but when they are riveted, folded, or in the case of wires, twisted together they may behave independently of one another because they are still separate pieces of metal and usually have an insulating film of oxide on their surfaces separating them.

The solder alloy in a joint absorbs some of the strain on a joint caused by differential heating without loosening the joint. An unsoldered joint or wire splice may become a poorer connection each time movement takes place due to temperature variations as the layers of metallic oxides increase on the metal surfaces.

It has been indicated above that a new alloy is formed between the solder and the base metal. The physical properties of this new alloy are not the same as the original solder and the tensile strength, shear strength, or creep strength of the soldered connection depends on the alloy formation that took place during the soldering process. This points out the importance of using correct procedures and techniques during the soldering operation to insure the highest quality soldered connection.

2. Tin-Lead Solders

A better understanding of solder can be obtained by examining the melting characteristics of metals. A pure metal changes form a solid to a liquid at one temperature. Alloys, however, melt at different temperatures depending on their composition. A chart showing the cooling curves for different tin-lead alloys is called a constitutional diagram or a tin-lead fusion diagram (Fig. 1).

Tin-lead fusion diagram

The tin-lead fusion diagram will help explain the solvent action of molten solder. Notice that lead melts at 621° F. As tin is added to lead, it lowers the melting point of the mixture along the line ab. Tin melts at 450° F. and when lead is added to tin, it lowers the melting point of the mixture along the line cb. At point b, where the two lines meet, there is an alloy of the lowest melting point of the metals, lead and tin. This alloy is known as the "eutectic" composition consisting of 63% tin and 37% lead and has a precise and distinct melting point of 361°F.

Careful examination of this diagram will show that all solders in the tin-lead series except the eutectic alloy are mixtures that do not melt sharply from solid to liquid but pass through an intermediate range of plasticity from the liquid to the solid state. The eutectic alloy, while really a mixture, has the metallurgical properties of a single ingredient.

The melting point of solder requires two figures: First is the temperature of original plasticity, while the other is the temperature of liquefaction - when it is completely liquid. Between these two temperatures, solder is neither completely liquid nor completely solid. The difference between these two temperatures is known as the pasty range and is shown in Fig. 2. The most widely used of the tin-lead solders are those from 35A to 50A in the classification used by the American Society for Testing Materials (ASTM). These solders provide optimum wetting and flow characteristics and good strength at low temperatures and are often referred to as general-purpose solders. A 60A solder, close to the eutectic, would be particularly desirable for delicate work when the soldering temperature is critical, such as the dipping of printed circuits. 70A solder would be used to solder zinc.

Impurities and alloys

Some properties of solder that are affected by other metals include the flow or spread, wettability of metals, and surface tension. Aluminum is limited to less than .005% by the ASTM because it increases the surface tension and retards the flow of solder. Zinc contaminated solder gives a rough, porous, or frosty appearance. Antimony increases the strength and the plastic range of solders. An alloy of 95% tin - 5% antimony is sometimes used in sweat tube fittings because it has greater strength at higher temperatures. Antimony adversely affects the soldering of galvanized iron because of the formation of a zinc-antimony compound that has a high melting point. Bismuth is sometimes added to the tin-lead alloy to make a low melting alloy.

Impurities of even small amounts will have a harmful effect on a soldered connection so it is important that good quality solder of a reliable brand name be used.

3. Soldering Flux

The oxide film on metals, that was mentioned earlier, is familiar to all of us but we may know it by a different name. When copper has an oxide on it, we say that it is tarnished or corroded, and we say that oxidized iron has rusted. For the metallurgical action between solder and the base metal to take place, the oxide must be removed. One function of a soldering flux is to remove the oxide from the surface of the metal and keep this surface clean throughout the soldering process.

Flux action

The action of the flux in the soldering operation has been studied and many ideas have been advanced as to the exact process that takes place. It is thought that the flux (1) exerts a slight chemical reducing action that loosens the oxides on the surface of the base metal, (2) dissolves these loosened oxides and carries them in suspension, (3) forms a protective layer on the cleaned metal, thus preventing a new oxide film from forming, and after being displaced by solder on the clean metal, (4) carries the suspended oxides to the surface, as the molten solder solidifies.

Solder flux was never intended to remove paint, varnish, tars, or heavy forms of dirt or other materials. This material should be removed by mechanical or chemical means prior to soldering.

Kinds of flux

The composition of the base metal and its final use have considerable influence on the selection of the flux. For convenience these fluxes may be divided into three general groups or classes: (1) corrosive (chloride or acid-type flux), (2) intermediate (organic nonrosin base), and (3) noncorrosive (rosin-base).

Melting Characteristics of Tin-Lead Solders

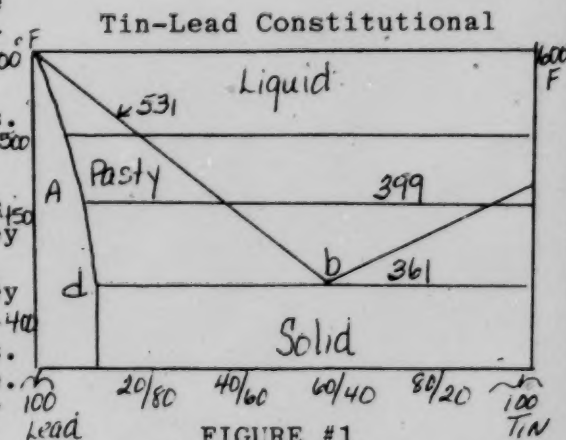
ASTM Classification	Composition		Temperature		
	Tin %	Lead %	Solidus °F	Liquidus °F	Pasty Range °F
	0	100	621	621	0
5A	5	95	572	596	24
10A	10	90	514	573	59
15A	15	85	437	553	116
20A	20	80	361	535	174
25A	25	75	361	511	150
30A	30	70	361	491	130
35A	35	65	361	477	116
40A	40	60	361	455	94
45A	45	55	361	441	80
50A	50	50	361	421	60
	55	45	361	399	38
60A	60	40	361	374	13
63A	*63	37	361	361	0
	65	35	361	367	6
70A	70	30	361	378	17
	75	25	361	387	26
	80	20	361	399	38
	85	15	361	410	49
	90	10	361	423	62
	95	5	361	435	74
	100	0	450	450	0

*Some charts show Tin as 62% and Lead 38% as the eutectic mixture.

Fig. 2 ASTM numbers 35A to 50A are the most commonly used solders. Where a wide plastic range is desired, as in automobile body work, choose a solder of 20-30% tin.

The corrosive fluxes are prepared from inorganic salts, a halide or phosphate of zinc, aluminum, calcium, or tin. The name "acid" applied to these fluxes is merely a name. The fluxes are actually salts. These fluxes are the most corrosive and the most active of the three classes. They can be made to remove the most tenacious oxide films. They are thermally stable, and work well with any form of heating because they do not burn or decompose at the temperatures at which soft solder melts. The residue is hygroscopic in nature. It is hard and dry immediately after soldering but the residue gradually absorbs water from the air which finally dissolves and dilutes it and causes the residue to spread over a wide area.

This hygroscopic characteristic is also beneficial in removing residue after soldering. When the residue has softened from the absorption of moisture, it can be washed away with hot water or steam. The corrosive fluxes which



highly active and thermally stable are unsuited for most electric assemblies because the most of these cannot be washed to remove the residue.

Corrosive fluxes should not be kept in open containers near tools and, if any flux is spilled on a tool, it should be removed at once and the tool oiled to prevent corrosion.

The popular idea that soldering pastes are noncorrosive is erroneous. A corrosive or inorganic flux containing salts will have a corrosive residue whether it is used as a solution or as a paste.

One of the main ingredients in most corrosive fluxes is zinc chloride. Since zinc chloride has a melting temperature well above the melting temperature of most commercial solders, unmelted particles may be entrapped in a soldered joint and continue to corrode and weaken the joint.

Intermediate fluxes are almost as active as the corrosive fluxes but their active period is shorter because they are susceptible to thermal decomposition. Since they tend to burn or become volatile when heated, they are not suitable for torch or flame soldering. The residues are essentially inert.

The noncorrosive fluxes are primarily rosin based. The chemical properties of rosin are such that, when heat is applied and it is a hot liquid, it is sufficiently corrosive to remove the oxides but when cooled it reverts to an inert and inactive form. The rosin fluxes are unique because of the characteristics of the flux residues which are hard, noncorrosive, and electrically nonconductive. Liquid rosin fluxes are corrosive, however, and this chemical activity is the result of the solvent.

Activated rosin or resins have had small amounts of organic compounds added. These fluxes are more active in cleaning metals than rosin alone. Reliable manufacturers have prepared these fluxes so they leave a nonconductive residue. With these fluxes, the cleanliness of the metal surfaces is not so critical and solder flow is quicker.

Forms of flux

Most external fluxes are available in liquid form but there is some difficulty in using liquid flux on a vertical surface. Liquid is easily spilled and on a repair job it may run on surfaces where it can be harmful. Liquid flux is sometimes sold in cans but these may eventually rust through. Glass containers prevent this problem but they in turn are easily broken. It is, therefore, often desirable to have flux in another form.

Paste flux stays on the work, does not spill easily or spread wide or run off easily even in a vertical application. Paste flux is generally less messy to use than most other forms which accounts for its popularity.

Flux-core wire solder is perhaps the handiest form of flux to use because both flux and solder are delivered to the joint simultaneously. 892 Another advantage of flux-core

solder is that under ordinary uses the volume or flux is exactly correct for the amount of solder and since manufacturing tolerances are carefully controlled the flux-to-solder ratio is uniform. This is a volume ratio and the percent of flux is uniform for a given core size. With externally applied flux, the amount applied is almost always greater than the amount needed. There is questionable advantage to the ornamental shape of the flux core, be it star-shaped, multiple core or simply a single round core.

Soldering compounds appeal to solder users because they feel they can apply solder and flux in one simple operation. These compounds are made by adding finely powdered solder to a viscous flux and mixing these ingredients so the solder is held in suspension in the mixture. These compounds are most useful in the manufacture of delicate equipment where conventional heating methods cannot be used.

Two limitations of these compounds are readily apparent. Since the solder may be as much as ten times heavier than the flux, it is difficult to imagine that the compound has a homogenous mixture since it is subject to varying conditions of temperature, vibration, storage, etc., before it is finally applied by the user. These compounds are also often prepared with an excessive amount of flux. Some have a 50% flux content which means that an excessive volume of flux residue will usually result. If additional solder is required for the joint, additional (unnecessary) flux must be added in order to get the necessary solder. While it is impractical to try to add solder to the compound, the user can partially correct the problem of a poor mixture by thorough stirring before use.

Characteristics of a good flux

The quality of the soldered connection depends to a large extent on the flux used. The characteristics of a good flux include these: (1) provide an oxide-free surface, (2) prevent reoxidation, (3) possess thermal stability, (4) be readily displaced by solder, (5) cause a minimum of corrosion after soldering is completed, and (6) be safe.

Oxide removal is the prime function of a flux. Practically all clean metal, when exposed to the atmosphere develops a film of oxidation or tarnish. The thickness of this film depends on the time the metal has been exposed, temperature of the metal and the corrosive action of the atmosphere. These oxides cannot be removed by commercial petroleum solvents that you would use to remove tar, grease, or gums. The flux must contain chemicals that will react with these oxides and carry them in suspension.

To prevent reoxidation is sometimes a problem, because as heat is applied for the soldering process, the rate of reoxidation is increased. The flux must form a protective layer to prevent reoxidation until it can be displaced by solder (Fig. 3).

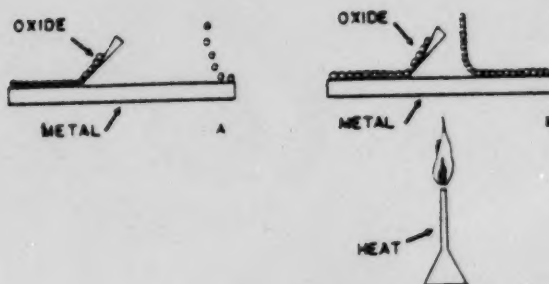


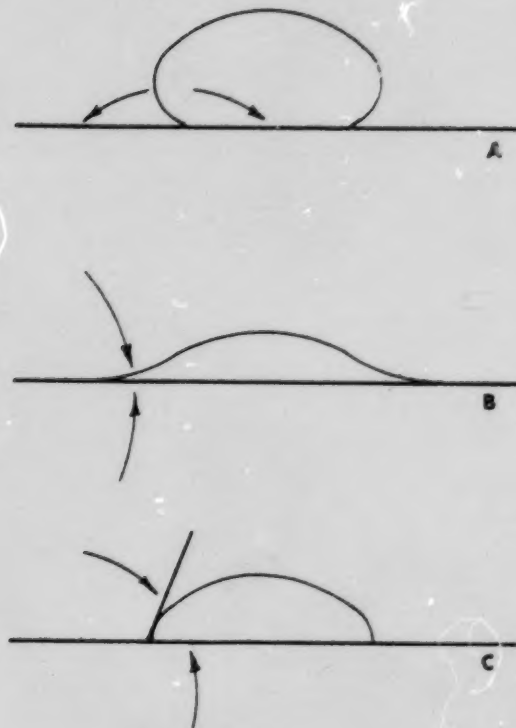
Fig. 3. If the oxide is scraped from the surface of the metal, the atmosphere will cause the oxide to form slowly, as in "A." If heat is applied, the oxide will form much faster, as in "B."

Thermal stability of a flux means that it will perform its fluxing action at the temperature at which soldering is done. Some materials are flammable at soldering temperatures and are of no value as a flux. Others have water mixed with them which boils at soldering temperatures. A flux vehicle that has been recommended by the Tin Research Institute is polyethylene glycol because it has a high boiling point and thermal stability.

Solder displacement of the flux on the cleaned surface is necessary for good wetting. When molten solder leaves a permanent film on a metal surface, it is said to wet the surface. Without good wetting there cannot be good soldering. In order for wetting action to take place, there must be a stronger attraction between the atoms of the solder and the base metal than between the atoms of solder itself so the solder spreads well. The flux must have an affinity for metal but should be lower than the affinity of solder so the solder displaces it. If the solder displaces the flux and wets the metal, the metallurgical action between the solder and the base metal will take place. For instance, when copper is soldered with tin-lead solder, a copper-tin compound is formed as a thin layer at the surface of the metal. Fig. 4 illustrates the visual difference between nonwetting, partial wetting, and good wetting.

A noncorrosive residue is most desirable because all crevices in connections and assemblies cannot always be thoroughly cleaned. Since all fluxes must be somewhat corrosive to be effective, it is recommended that all excess flux be either mechanically or chemically removed after soldering.

A safe flux is nonirritating with harmless fumes. It has a flash point higher than soldering temperature. It is nonexplosive and should be safe enough to be stored in the shop with the usual precautions for protection of children. Additional suggestions for safety are made in a later section.



Removal of flux residues

The connection, as well as adjacent areas may be covered with flux residue, spattered flux, and flux condensate. These materials may be removed mechanically or chemically. For corrosive flux residues, use sal soda in hot water with ammonia or rinse with a mild solution of HCL followed by a thorough washing with water. For intermediate flux residues, alcohol, solvents, or household detergents and hot water will remove the residue. The residue of a noncorrosive flux may be left unless there is so much present that the final appearance is affected. In this case one of the processes used for intermediate fluxes may be used to remove it.

4. Sources Of Heat For Soldering

The factors that enter into making a soldered joint include solder, flux, and a source of heat. The heat necessary to raise the temperature of the solder and the metals being soldered to the melting temperature of the solder may be supplied in several ways. Different equipment, methods, and processes all have certain advantages and limitations. The choice of equipment or method of soldering depends on the material to be soldered and the size, shape, and conditions under which the operation occurs. Other heating methods, in addition to those described below include induction heating, resistance heating, oven heating, and the use of ultrasonic energy.

Soldering irons

The soldering iron is the most familiar method of applying heat by conduction. The copper bit may be heated

electrically or by a flame.

Electric soldering irons are designed for continued heating when plugged in. The external element iron has a heating element wound around a metal core. As the coil is heated, the heat is transferred to the core which heats the tip. The heat output rate on irons made by different manufacturers varies greatly. These irons range in size from very small to very large. Some irons used in micro-electronic work have tip diameters of 1/32 inch and are rated at 12 watts. Large irons used in heavy sheet metal work may be 1 3/4" wide and rated at 700 watts. It would be convenient if a tip diameter or a certain wattage or a certain weight could be specified for general use or for a specific use. The best guide would be to take a typical application to the supplier and determine with him (by elimination of certain models in use, if necessary) which size should be purchased.

It is far better to use a larger iron or tip with adequate heat than a smaller iron with not enough heat. It may seem surprising but this is true when soldering temperature-sensitive components. More damage is often caused by prolonged heating time than by high tip temperature and an iron with plenty of heat available.

Try to choose a soldering iron with an adequate reservoir of heat immediately available to the tip. More heat and faster delivery can be obtained by shortening the tip or reducing (turning down) the diameter of the extended tip. If less heat is desired, select one with a longer tip or one with greater mass or larger diameter. Do not pull out a tip to compensate for reduced length as this may shorten the element life. Soldering irons with the element inside the tip usually have a limited heat output.

Electric irons are convenient where light weight and ease of manipulation are important and where open flames would be dangerous.

These irons are sold at hardware stores for intermittent use, light soldering, and electrical work.

Soldering guns have quick heating tips made of a special alloy. They use a voltage step-down transformer. They are highly satisfactory for light duty intermittent use such as soldering of electrical connections.

Soldering irons

Soldering irons are actually made of copper and are sometimes called soldering coppers. Copper is used because it will readily absorb and release heat and because it is fairly resistant to corrosion and oxidation.

Soldering irons are usually sold in pairs so that one may be used while the other is heating. They are sold by weight and each iron from a three-pound pair weighs 1.5 pounds not including the handle and shank. A one-pound iron would probably be most useful for average shop work since it can be quickly heated and conveniently handled. It should be remembered that while large irons require

heating less often they are also less convenient to use.

The soldering iron must be heated before being used. Almost any available source of heat, such as a blow torch, LP gas burner, plumber's fire pot, gas or gasoline stove, furnace, gas or coal forge, or even an open fire can be used to heat the soldering copper. If a furnace, forge, or open fire is used, it may be desirable to place the copper inside a pipe to protect it from dirt and impurities from the fire.

It is difficult to recommend the correct temperature to heat a soldering iron. The experienced tinner holds the iron about six inches from his face. If the heat of the iron can be felt at this distance, it is hot enough to use. Under no circumstances should the iron be heated until it is red hot.

Torch soldering

A torch may be used for soldering when the size or the shape of the work to be soldered make the use of an iron impractical. The torch may be LP gas, air-acetylene or oxygen with natural gas, or oxy-acetylene.

The small LP-gas bottles contain propane, a liquid under pressure. When it is released as a gas, it expands to over 400 times its original volume. As it passes through the burner, it is mixed with air and burns as a clean hot flame.

The flame produced by the air-acetylene torch is produced by burning acetylene and free air from the atmosphere. The air is mixed with the acetylene in the appliance in much the same way as air is mixed with city gas in a stove or water heater. The correct flame, from the proper mixture of acetylene is pale blue with a bright, sharp inner cone. The flame temperature is approximately 4,000 degrees F. This is hot enough for light silver soldering and most soft soldering jobs. The flame from the oxy-acetylene torch is too hot to do satisfactory soldering.

These torches have a number of advantages over other systems of heating. The on-off control of the flame is instant without pumping, priming, or waiting for warm-up. These units are portable and ready for work as soon as they are lighted. The flames have no objectionable fumes. They can be used indoors or out. The torches operate fairly well in drafts, wind, and other conditions that make certain sources of heat hazardous. There is no smoke or soot to discolor the working area and no carbon deposit to prevent the flow of solder.

In the open (direct) flame method of soldering, the flame heats the work and the work melts the solder. This system is faster than others because there is no copper to be heated. It is more efficient in the use of fuel because heat is applied directly to the base metal. More heat is available because it is applied directly to the work, but it is sometimes difficult to do neat soldering work because the heat cannot be controlled.

In the enclosed (indirect) flame method, the flame is applied to the soldering copper and the copper in turn heats the work. This system has the advantages of better control of the heat. An operator with limited experience will probably do better work this way. More delicate work is possible, especially where damage to adjacent materials might result from the use of open flame.

Use as small a flame as will maintain correct heat of the tip. A large flame wastes fuel. It hastens the need for retinning and causes excessive scaling thus shortening the life of the tip. Overheating increases oxidation and produces poor joints.

5. Soldering Procedure

There are a few fundamental principles of soldering that must be understood and followed before you can expect good results. Many examples of poor soldering indicate that appliance servicemen, mechanics, electricians, and plumbers do not always follow these basic principles and steps in procedure. Most attempts to short cut or avoid one or more of these steps result in an unsightly or unsatisfactory connection that will not hold or will fail in a short time. Someone has said "There are three laws for successful soldering-cleanliness, cleanliness, cleanliness".

Good soldering procedure consists of certain basic steps: (1) fitting the metal parts together that are to be soldered, (2) cleaning the metal surfaces, (3) applying the flux, (4) assembling the parts, (5) applying the heat and solder, (6) cooling the joint, (7) removing the surplus solder, and (8) removing the flux residue.

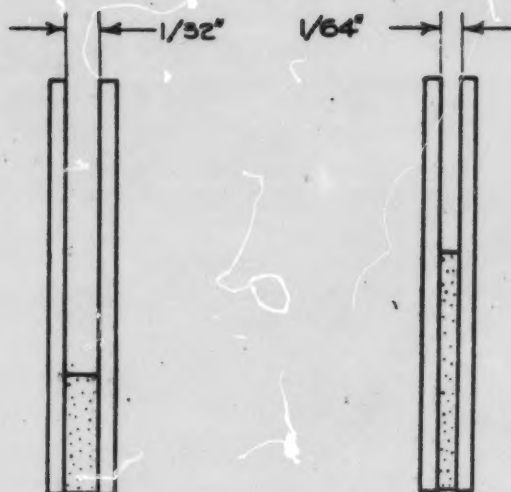
Fitting the joint

The clearance between parts being joined should be such that the solder can be drawn into the space between them by capillary action. The capillarity is greatest when the joint spacing is narrow.

If two metal plates are spaced 1/32-inch apart and a drop of solder is applied to the opening it will move up between the plates and distribute itself in the opening. If the plates are moved to 1/64-inch apart, the area covered by the solder will be doubled. The liquid solder is drawn into the opening and retained there by capillary action. The force of this capillary action increases as the distance diminishes (Fig. 5)

The mechanical strength of a soldered joint is affected by the solder, defects, porosity, flux inclusions, unsoldered areas, and other factors. The strength of the joint is usually lower than that of the base metal since solder itself is not a strong metal. The mechanical strength is dependent to a large extent on clearance between metals. A clearance of .003 to .005 inch is suitable for most work.

The basic requirements of a good solder joint are that it must: (1) be mechanically strong or provide a good electrical contact with a minimum of resistance, (2)



be neat in appearance, and (3) be quickly made. Most sheet-metal solder joints are variations of a lap or butt joint. Lap joints are preferred. Soldered joints are not designed for strength but certain strength is necessary to assure reliability. Tensile tests, conducted at the Ballistic Missile Agency at Huntsville, Ala., have proven with scientific tests that solder joint strength depends on the kind of base metal and its surface preparations.

When other factors are correct, such as flux and temperature, all that you have to do to touch the solder to a properly fitted joint (copper tubing) and the solder will flash through the joint and automatically fill it. The addition of more solder than is required to fill the joint is wasteful and will make an unsightly connection.

Cleaning the metal

A chemically clean surface is needed to make certain that the solder can wet the surface of the metal and alloy with it. In the soldering process, the solder is partly changed to a new alloy due to the solvent action between the metals in the solder and the base metal. Anything that interferes with the uniform contact between the base metal and the solder will prevent the formation of a sound joint. All foreign matter, such as oil, grease, paint, rust, and oxide must be removed by mechanical or chemical means prior to the soldering operation.

Grease and oil can usually be removed satisfactorily by wiping with a solvent-saturated rag. Paint may need to be removed by scraping or using paint remover. For some applications mechanical cleaning may be sufficient. Sanding, filing, grinding, cleaning with steel wool, wire brushing, or scraping with a knife may be used. Most dry, mechanically cleaned surfaces can be soldered without further chemical cleaning.

Most metals are attacked by the oxygen from the air. This process is called oxidation and the produce formed is called an oxide. A freshly cut piece of copper wire has a bright appearance. As the copper combines with oxygen,

a coating of dull colored oxide forms and the copper is said to have tarnished because an oxide has formed. This oxide protects metals from further action by oxygen. When iron rusts, it is changing to iron oxide. This action does not form a protective layer but may continue until the base metal disappears.

Other gases, such as hydrogen, carbon dioxide, and water vapor, affect the base metal as well as oxygen. They create compounds or barrier films on the surface of the metals that tend to insulate the metals and prevent good soldering.

All films, oxides as well as dirt and foreign material, must be removed for uniform wetting action and alloying by the solder.

Applying the flux

Flux can be simply defined as flow. In the soldering process, the flux must do other things than flow on the base metal.

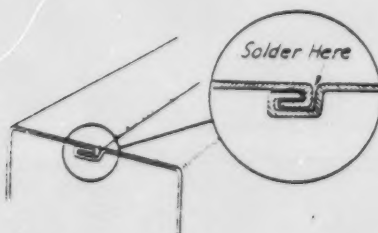
The flux removes the oxide film from the base metal by dissolving or loosing it and floating it off in suspension. The molten flux, then forms a protective coating over the bare metal that prevents the oxide from reforming. The molten solder displaces the flux and bonds to the base metal. The molten solder builds up in thickness and when the heat is removed it solidifies.

The flux may be applied by wiping, brushing, spraying, or dipping. It may be contained in a core (as in cored wire solder) or mixed with solder (in soldering compounds) and applied simultaneously with the solder.

Assembling the parts

If the joint to be soldered is in copper tubing, the fittings and pieces of pipe should be assembled in the exact position they are to remain after they are soldered. If the connection is an electrical splice, the conductors should be twisted so they are mechanically secure before soldering and then soldered as stated in the National Electrical Code.

If the connection is in sheet metal, the parts being joined should be assembled and held in place so the solder can complete the joint. (Fig. 6)



Applying the heat and solder

The usual way to transfer heat from the soldering copper to the base metal is through a well tinned tip.

Tinning a copper is the process of precoating it with solder whether or not the solder contains tin. A soldering copper will not work successfully unless the faces (flat surfaces) of the tip are covered with a thin coating of solder. Thus, tinning keeps oxide from forming on the hot copper.

First, remove the oxide coating which covers the copper. This can be done by filing, sanding, or scraping until the soldering copper is bright and free of oxides. Inspect the copper carefully. If it has pits, additional filing may be necessary to reshape the copper. Also, be sure each face of the copper is perfectly flat. If it is not flat, only the high spot of the curved surface will touch the metal and less heat will transfer to the metal.

Next, protect the faces of the copper against further oxidation. Do this by heating the copper and rubbing each face in powdered resin, powdered sal ammoniac, or on a block of sal ammoniac, by dipping it in a solution made of powdered sal ammoniac and water, or in a solution of zinc chloride. The zinc does not oxidize as quickly as copper. Commercial fluxes or pastes may also be used. Do not dip the soldering tip in the flux as this leaves a residue on the tip and may deteriorate the remaining flux in the can.

Next, coat the faces of the copper with solder. Heat the copper hot enough to melt solder but not red hot. Then rub each face of the copper on a bar of solder, or on a drop of solder on an asbestos board. Regardless of how this is done, the solder should quickly flow over each face of the copper, coating it with a bright layer of molten solder. Other methods include rubbing the faces of the two soldering coppers together to spread a drop of solder or rubbing a drop of solder on the face of the iron with a file.

When soldering overhead it is advisable to tin only one face of the copper.

When the copper is properly tinned, you are ready to use it to heat the metal. Apply heat for three purposes, (1) to change the solder from a solid to a liquid state, (2) to reduce surface tension of the solder so there is a solder flow to the base metal, and (3) to help the metal solvent action to take place.

To get maximum heat, apply the tip of the soldering copper at the correct angle, and the flat side (face) of the copper to the point of contact between the iron and the work. It is at this junction that the heat flows from the iron to the metal. As the base metal is heated, oxides form which must be removed by flux. The solder flowing between the iron and the metal forms a column for thermal conduction which increases the rate of heating of the base metal. If the cored solder is applied to the top of the

iron, the flux may not flow down over the iron to the metal.

When soldering with bar or wire solder, pick up some solder with the tip of the heated copper and apply it to the work. A beginner is apt to get too much solder on the copper. The application of the correct amount can only be learned by practice.

Place the heel of the face of the copper (Fig.7) on the work to raise the temperature of molten solder.



Cooling the joint

A soldered joint must not be moved until it is completely hardened. The experienced workman knows how long to hold the surfaces together for the solder to solidify. The beginner can watch the joint and see the solder "freeze" as the joint cools. If the connection is moved while the solder is in a plastic state, it will have a characteristic frosty or crystalline appearance. A bright joint will result when solder is permitted to solidify with the joint held firmly in place.

Removing the surplus solder

Care should be taken to keep from adding so much solder that it must be removed. If the solder has run on an area that is not fluxed, it will not adhere very tightly to the metal. This can be scraped or brushed to remove it.

If the solder and flux have spread where they should not have, this solder may need to be scraped or filed to remove it.

Removing the flux

After the soldering job is finished, the corrosive residues that might attach the base metal of the solder joint must be removed. If the connection will be exposed to high humidity during its life, if it is to be painted, or just for the sake of appearance, the flux residue may need to be removed.

Mechanical removal of fluxes can be done with a wire brush, steel wool, or fine emery cloth.

Corrosive flux residues should be neutralized and scrubbed and flushed with water to be sure they are removed or they may continue their corrosive action.

Special applications

Dip soldering. This process is especially useful in the electronics industry for printed circuits or where many joints of an entire unit, such as an auto radiator, can

be soldered in one operation by dipping it in molten solder. Splices of electrical wires in residential wiring can be dip soldered on the job.

All preliminary operations--forming, degreasing, cleaning, and fluxing must be done before dipping. The molten bath of solder supplies both the heat and solder necessary for completing the joint.

Use only a cast iron dip pot to prevent solvent action by molten solder. It should have little surface area in proportion to volume in order to reduce surface oxidation. Use a soldering pot that is large enough that the units being dipped will not lower the temperature of the solder bath so that effective joints cannot be made. This is often the cause of poorly soldered electrical connections.

Be careful not to get water in the dip pot. If it gets below the surface of molten solder, it turns to steam and its rapid expansion will cause the solder to be expelled with explosive force.

A small hole may be soldered two ways; (1) Place the heel of the copper on the metal and move it around the hole so the metal is coated with solder and the hole is filled. (2) Place the point of the copper in the hole and revolve it until the hole is filled. The second method is not as desirable as the first because the solder bonds to the base metal on a very small surface.

A large hole can be soldered or repaired by "sweating" on a patch. Cut the patch a little larger than the hole to be soldered. Then clean and flux one side of the patch and the surface around the hole. Place the patch, cleaned side down, over the hole and solder around the edges of the patch. Place the heel of copper on the patch with the soldered tip extending over the edge and the solder will be drawn back under the patch. To "sweat" on a patch cut the patch and clean and flux it as above. "Tin" both the surface of the patch and the surfaces around the hole. Place the patch over the hole, tinned side down, and hold it in place with some suitable object, such as tang of a file. Apply heat to the patch with the heel of a copper, moving the copper along over the patch until the tinned surfaces of the patch and the metal are securely joined. Do not hold the patch in place with a tempered tool such as a screwdriver. This "sweat" method is superior to the solder repair previously described.

Suggestions for successful soldering

These steps will usually result in a strong soldered connection that is neat in appearance.

1. Choose the right solder for the job
2. Prepare the joints for a .003 to .005" solder film
3. Choose the right flux for the job
4. Clean the work carefully
5. Be sure the members of the joint are mechanically secure.

6. Apply heat to the heavier member, if they vary in size.
7. Apply solder in the correct manner.
8. Avoid overheating the members or the equipment
9. Avoid moving the joint until it is fluffy hardened.
10. Remove excess flux

The surface of the solder should be smooth and bright and flow neatly into the surfaces of the members joined.

A poor soldered connection can usually be traced to the failure to follow the above suggestions.

6. Maintaining Soldering Irons (Coppers)

Maintenance of soldering irons

It is impossible to do good and efficient work unless the tools you use are properly maintained. Clean tools are essential to good workmanship. Your time will be spent reconditioning the equipment so that it is satisfactory rather than doing the work you are supposed to do. The following are some suggestions for maintaining soldering irons in good condition.

1. Do not overheat a bit. If a flame is used to heat the soldering iron and it begins to show a green fringe, this indicates the iron is overheating. A large flame hastens the need for retinning and causes excessive scaling, thus shortening the life of the tip. If the bit is overheated, it will not stay tinned and rosin fluxes will carbonize quickly.
2. Use the mildest flux that will coat the bit and solder effectively. Excessively strong fluxes will rapidly corrode the bit as well as other parts of the soldering iron.
3. Keep the tip of the bit well tinned.. This will increase the speed of soldering and reduce scaling of the bit.
4. Remove the copper bit from the electric iron periodically and clean it. The scale acts as an insulator and reduces the heat conductivity of the iron. Dressing the tip of a bit reduces the length and thus increases the temperature at the tip.
5. Do not pull out a tip to compensate for reduced length as this may shorten element life.
6. Clean a solder-coated tip when it becomes dirty or discolored by wiping it with steel wool or a wet cellulose sponge or cloth. Correct dull spots on a plated bit with flux and solder as soon as they appear. Plated bits should never be scraped or filed as this removed the protective coating.

After thinning, wipe off the excess solder with a damp cellulose sponge, damp cloth, or by dipping in a

sal-ammoniac solution.

As the soldering copper is used, the tinning wears thin and may need to be retinned. This may be done in one of several ways. After heating the copper, dip it in a zinc chloride solution and apply more solder or dip the copper in sal ammoniac solution and retin it.

7. Silver Soldering

A silver soldered joint is stronger than a soft soldered joint. A soft soldered joint has a shear strength of 4000 - 5000 psi at room temperatures but at 250° F. this drops to less than 350 psi. At room temperature a silver soldered joint has 40,000 psi and at 250° F. this only drops to 20,000 psi.

Hard soldering

Silver soldering is sometimes called hard soldering or silver brazing. A typical silver solder contains 45% silver, 30% copper, and 25% zinc.

Hard solders do not penetrate the full depth of the joint as readily as soft solders. It is not necessary to have more than nominal penetration providing a uniform light fillet because of their high physical strengths. The high temperatures (approximately 1250° F.) necessary to cause these hard solders to flow will anneal the tube at or near the joint. A well filleted joint will be stronger than the tube at this point.

Importance of a good fit.

The importance of a good fit on the parts to be silver soldered are the increased ease of applying the solder, increased strength, improved corrosion resistance, and greater economy.

Capillary force is increased with a good fit and hard soldering of tubing especially, depends on capillary action to pull the solder into the joint area. A poor fit will tend to reduce capillary action and cause the solder to fail to flow or flush out of the joint.

Strength is increased if the thickness is about .003 inch. As the thickness increases the strength decreases but a joint .003 inch thick will have a tensile strength of 100,000 psi compared to 48,000 psi for hard drawn copper tubing.

Corrosion resistance is increased if the area exposed to corrosion is reduced by a good fit at the joint.

Cost is reduced with a good fit because less solder is required. Silver alloys are expensive and must be used in minimum quantities to be economical applications.

Importance of proper cleaning

Attempting to silver solder unclean surfaces will usually result in a poor connection because the soldering alloys will not flow over or bond to oxides. This is especially important if oil is present because oily surfaces tend to repel the flux leaving bare spots in the joint.

The presence of dirt or scale or oxides prevents the flux from functioning properly.

The tube and fitting need not be polished as brightly as is necessary for a soft solder joint but they should be free of oxides and stains. Sand paper or emery cloth may be used but avoid removing excessive amounts of metal. No. 00 steel wool is satisfactory if an oil-free solvent is used to remove all traces of oil present from the steel wool.

Apply the flux

Apply a thin film of silver solder flux (saturated solution of borax) to the surfaces to be joined with a brush. In places where there is danger of entrapping flux in the system, apply a small amount of flux to the face of the connection. When it is heated, sufficient flux will be drawn into the connection by capillary action.

Assemble the parts to be soldered immediately after fluxing. If they are not, the water in the flux will soon evaporate, the dried flux may flake off, and the metal surface will be exposed to oxidation.

Apply flux only to those parts where it is desired to place the solder because the solder will flow over the base metal wherever flux is present.

Heat the joint

There are several different methods of heating that can be used in silver soldering. Regardless of the method used, it is important that both members being joined be heated uniformly and that both reach the soldering temperature at the same time and as quickly as possible. Speed is important to reduce the amount of oxidation formed during the soldering process.

A neutral oxyacetylene flame is recommended for pipe sizes larger than 3/4" to 1". An air-gas torch may be used for smaller sizes. Play the heat over the entire joint until it is uniformly heated to a dull red. If fittings are larger than 1" in size, heat a 1" or 2" arc.

Apply the solder

When both members of the joint have reached the soldering temperature, apply the alloy. It is only necessary to apply a small amount of solder to a few places around the joint. Capillary action will cause the solder to flow around and into the joints. It is not necessary to use a large amount of solder--just enough to fill the recesses and make a good fillet. It is a good practice to maintain the heat for a short time to be sure that all flux and gases have been flushed out of the joint.

Clean the joint

When the joint has cooled, it is necessary to remove the remaining flux from the joint area since it is corrosive and presents an unclean appearance. Scrubbing with a small wire brush and hot water will usually be satisfactory.

Silver Soldering Trouble Shooting Chart

Problem	Cause	Remedy
Solder spreads too quickly	Metal too hot	Use less heat
Solder balls up, won't wet surface	Metal too cool Surface dirty or oxidized	Use more heat Clean metal, reflux and resolder
Solder wets surface, won't fill joint	Clearance too great between pipe and fitting	Use solder with higher nickel content
Open spots in flux coating	Surface dirty or oily	Clean with solvent before soldering
Solder flows on pipe	Fitting is too cool or pipe is too hot.	Apply heat more directly to fitting.

8. Installing Sweat-Type Fittings

Sweat-type fittings are a means of making joints and connections in copper tubing. They are widely used in home plumbing as well as in refrigeration and other industrial applications. They should not be used for connections on gas lines because in the event of fire the solder will melt and release the gas.

Types of tubing

Generally there are two types of copper tubing used--hard drawn and soft drawn.

Soft drawn copper tubing is used on small applications. It is easy to work with and can be bent into any desired shape. Even though this tubing is easily shaped it has a tensile strength of 30,000 psi. Soft drawn copper tubing is supplied in rolls or coils.

Hard drawn copper tubing is normally used on large units where long lengths of tubing are required. It is difficult to bend and usually comes in 20 ft. lengths. It is similar to pipe in appearance. Hard drawn copper tubing has a tensile strength of 48,000 psi. which makes it stronger than soft drawn copper tubing.

Both types of copper tubing are seamless. Copper tubing is available in sizes from 1/8 inch up to several inches in diameter. Sweat-type fittings are a quick and inexpensive means of making a joint. An inexperienced workman can do high quality work with very little training or practice if care is taken with each of the steps listed below. Since the melted copper is drawn into the solder fitting by capillary action, much as ink is drawn into a blotter, the space tolerance between the tube and fitting must be carefully controlled. This means that both types of tubing must be handled carefully to prevent the ends of the tubing from being dented or distorted.

Steps in installing sweat fittings

1. Cut the tubing-- Cut the copper tubing to the length required with a tubing cutter or a hack saw (32

teeth per inch). When sawing large diameter tubing, a template of thin straight edged sheet metal or paper may be used to mark a line to guide the saw cut. The ends of the tubing must be cut square.

2. Ream the tubing--Use a reamer or a round or half-round file to remove outside and inside burrs. Correct any distortion of the tube end. Improper joint clearance can lead to problems often caused by flux entrapment and inadequate bonding. Where insufficient clearances are used, such as fittings hammered into position, the capillary action in the joint is restricted and defects occur. When excessive clearances are used, there is some loss in mechanical strength and joints are apt to fail. Rounding or chamfering the edges of large diameter tubing will make it easier to insert the tube into the sleeve of the fitting.

3. Clean the tube and fitting--Clean the outside surface of the tube and the inside of the fitting until the metal is bright. All traces of discoloration must be removed. This must be done even though the tube and fitting appear to be perfectly clean. This is particularly important when soldering joints in large pipe. Some workmen rely on the corrosive action of the flux to clean the tubing but this is not recommended.

Emery paper is the most satisfactory material for cleaning. Special brushes are available to clean the outside of the tubing and the inside of the fitting. Fine steel wool (No. 00) may be used but oil in steel wool may make a poor joint. Files, rough sandpaper, and scrapers score the surface of the metal and help create a poor joint. After the tube and fitting are cleaned with emery cloth, apply the flux at once. Do not touch the cleaned surfaces prior to fluxing. Even a fingerprint may result in a defective joining.

4. Flux the tube and fitting--Apply a thin, uniform, and complete coating of flux or paste to a cleaned portion of the tube and fitting. Do not apply the flux too thickly as excess flux may form bubbles and prevent the solder from flowing into the joint. After the tubing has been inserted into the fitting as far as it will go, revolve the fitting or the tube once or twice to spread the flux evenly.

5. Heat the joint and apply solder--As the joint heats, move the flame back from the edge of the joint and apply the wire solder at this point. At the right temperature a drop of solder will melt from the wire. Continue to apply the solder which will be drawn into the joint until it is filled. Extreme care should be used to prevent overheating the joint which may cause the flux to burn. If so the solder will not enter the joint, and it will be necessary to reclean the surface.

The above procedure applies particularly to soldering fittings up to 2 inches in size. When soldering larger fittings, it is more difficult to heat them evenly because of the greater mass to be heated. There is a dif-

ference of opinion about whether one or more heating units should be used to make larger joints. Care must be taken to prevent spot overheating when more than one heating unit is used.

When one heating unit is used, the following procedure is suggested:

Move the flame uniformly over the entire area of the joint including the tube area adjacent to the fitting until the entire joint is heated almost to the temperature required to melt the solder. Next, apply the flame over a limited area, a 2 or 3 in. arc of the circumference of the fitting, testing with the end of the wire solder until the solder flows into the joint. The heated section should be thoroughly filled with solder. Similar sections should be heated and the same procedure followed, overlapping the completed section, until the entire joint has been filled.

An oxyacetylene torch with the medium-sized tip will be found more efficient for joints of 4 in. diameter or larger because the heat is lost rapidly from such a large area. For the smaller diameters, a propane or butane torch, an air-acetylene torch, or a gasoline blow-torch may be used.

Some workmen use a soldering compound that is a combination solder and flux. It is relatively expensive but it eliminates one operation. If this does not provide sufficient solder in the joint, wire solder can be used to supplement it.

To avoid applying too much solder to the joint, some workmen bend a kink in the wire solder, a distance from the end equal to the diameter of the tube. If 1/8 in. wire solder is used, it will require about 1/2 in. of solder to complete a 1/2 in. soldered connection.

6. Allow the joint to cool-- Do not move the soldered joint until it is fully hardened. This is very critical as many joints are ruined by disturbing them before the solder has completely solidified.

7. Remove surplus solder and flux with a damp cloth or brush.

If the fitting to be soldered is a Tee, it may be necessary to place a wet cloth over the parts already soldered to prevent that solder from melting. If the soldering is to be done on a closed system, some opening must be provided to permit expansion of gases. If water is trapped, the heat will generate steam and it will escape through the recently soldered joint causing it to leak. When sweating male and female adaptors, more time must be allowed for the solder to set as heavier fittings hold heat longer and do not cool as quickly as plain-type fittings.

Use asbestos board (transite) or sheet asbestos to protect walls, joints, and studding when sweating fittings. Be sure the pipes are free of water and steam and the section of pipe is vented or steam pressure inside the pipe will prevent the joint from sealing.

9. Soldering Stainless Steel and Aluminum

Soldering stainless steel

Stainless steels and similar hard-to-solder alloys, do not conduct heat as readily as common metals, such as brass, copper, and steel. The stainless-steel class of metals are also more highly resistant to chemical action than the ordinary metals listed above. These two special characteristics must be taken into account in successfully soldering this class of metals.

The first consideration is the poor conductivity of heat. This means that, when soldering is being performed, more heat must be used--not so much a higher temperature as a larger source of heat. In terms of the soldering iron, this means a larger iron. Very logically when a heavy gauge of stainless steel is used, more heat is required to completely liquify the solder, than would be the case with a lighter gauge.

The second characteristic, high resistance to chemical action, means that a rather active chemical is required to properly react with the resistant metal. This in turn means that extra precautions need to be taken in removing the excess soldering chemical after the soldering operation, and in avoiding the spattering of the soldering flux on the hands, arms, or clothing.

Realizing the need for attention to heat, due to poor conductivity of the metal, and the need for care in wiping the metal after soldering, and avoiding the spattering of the excess flux on metal, hands, or clothing, we are ready to proceed with detailed instructions.

Place the pieces to be soldered in position. Now brush on the stainless-steel soldering flux. Rub lightly with the brush if the flux does not seem to take hold at once. A small brush prevents spreading of the flux over too large an area. Only the surface to be soldered should be fluxed.

Ordinary solder is now applied from the top of a well tinned "iron" of sufficient size for the depth of the joint and the gauge of the metal. Be sure to use a large enough soldering "iron". If the best results are desired, use stainless-steel solder in place of ordinary 50/50 solder. (Stainless steel solder gives 2,000 or more pounds of extra strength per square inch; stays liquid in the joint more readily, and costs less in actual operation though its cost per pound is slightly higher).

Move the soldering iron along the joint as rapidly as the solder is observed to flow freely into the joint. This will give the proper speed and prevent going over the joint a second time. If the metal is of a heavy gauge, or if the joint is deep it will help to pass the soldering copper along the top of the seam as well as along the seam itself.

The second characteristic of stainless steels, as mentioned before, is the high resistance to chemical action, making necessary active chemicals in soldering. When the hot soldering copper strikes the stainless soldering flux, the active chemicals become very active due to heating and

are sprayed back into the joint as a hot vapor that readily draws the solder into the joint making a tight union. This active flux is also sprayed onto adjoining metal and must be removed.

This excess flux will react and in time dull the finish, so it must be removed. Remove this excess flux by washing with soap and water and wiping with a clean cloth.

Since an active chemical is needed for stainless steels, it is very irritating to the hands of face. Soap and water are advisable to remove the flux and stop the irritation. Of course it is advisable to wear gloves and some arm covering when soldering for some time. Safety glasses should be worn and good ventilation provided.

After the stainless-steel joint is cleaned and dried, an inexpensive polishing compound may be applied to brighten the soldered joint to make the appearance more nearly like the finish of the rest of the metal.

Soldering aluminum

Aluminum is so active chemically that it reacts almost instantly with the oxygen in the air to produce a thin film of aluminum oxide on the surface of the metal. The presence of this oxide film makes the joining of aluminum difficult. Aluminum has high thermal conductivity, which means that it conducts heat away from the joint area rapidly. It is recommended that points be used to support the members instead of resting them on a solid surface. A high input of heat is needed so that rapid joining can take place. Slow heating tends to encourage oxidation. On larger pieces use an oxyacetylene flame. Smaller members may be heated with a propane or air-acetylene flame. Use natural gas and air or gasoline and air flames.

Recent developments in research have made aluminum soldering a practical process but you are urged to follow the manufacturer's recommendations carefully.

The parts to be joined must fit together snugly. As a general rule the surfaces to be joined should be carefully cleaned.

You may use flux-cored solder or flux and solder applied to the joint separately for aluminum. Heat the part to be joined to promote flux action at the joint area. When the flux reacts, as indicated by smoking or melting, the solder will melt and flow into the flux puddle and adhere to the bare aluminum metal.

Friction soldering is the name applied to a technique where the parts are cleaned, fluxed, and heated. Use a glass-fiber brush to remove the oxide film to produce "tinning". After tinning, assemble the parts to be joined and add solder to complete the joint.

After the joint has cooled to room temperature, remove the excess flux.

Low melting point aluminum solders (300°-500° F.) consist of cadmium, tin, bismuth, lead, and zinc. These are fairly easy to apply, have fair strength and low resistance to corrosion.

Medium melting point aluminum solders (500°-700° F.) consist of cadmium, tin, and zinc, and have good strength and moderate resistance to corrosion.

High melting point aluminum solders (700°-800° F.) consist of zinc, tin, aluminum, and copper. These solders have high strength and good corrosion resistance.

10. Safety Hazards Connected With Soldering

Soldering can be considered a safe operation if proper safeguards are followed. Safety goggles should be worn when soldering to protect the eyes from hazards of corrosive flux and molten solder. There are certain hazards that must be avoided. Most injuries connected with soldering are caused by heat, fumes, or chemicals.

Hazards from heat

Soldering is a process that requires heat. Water sometimes may become entrapped behind molten solder or be introduced into a pot of molten solder. The water expands rapidly creating steam. This rapid expansion causes the molten solder to be expelled forcibly in all directions. This hazard illustrates the desirability of wearing safety goggles at all times when soldering.

Soldering dippers are sometimes heated continuously, so the molten solder is available when needed. Molten solder is easily spilled. It can cause painful burns and may ignite combustible material.

Electrically heated soldering irons should be placed in a fireproof holder. They should never be allowed to lie on the floor or workbench, where they may come in contact with combustible material or be touched accidentally by any person. Electric irons should not be left unattended without being disconnected. Excess solder should be wiped off the tip rather than flipped off.

Do not let acetylene or LP-gas escape near possible sources of ignition. Accumulations of these gases may explode if ignited. Acetylene and LP-gas tanks should not be stored in a confined space, such as a closet. Always use a regulator with air-acetylene equipment. Be sure the flow of gas is shut off before a torch is laid down. Do not leave a flame unattended. Keep tanks away from fire and heat.

A flame should never be used to solder a tank that has contained flammable material unless the tank is vented and filled with water up to the point where soldering is to be done.

Always be careful when using a flame near combustible materials. Keep a fire extinguisher handy or be sure of its location.

Hazards from fumes

Most soldering fluxes give off fumes or smoke while heat is applied. Other fumes arise from foreign materials, such as oil, grease, or paint, on the surface of the parts to be soldered. Most fumes are not harmful if breathed in small quantities. Prolonged inhalation of fumes may cause a headache or more serious effects.

Carbon tetrachloride should not be used as a cleaner because toxic fumes may arise from parts that have been cleaned with this material.

Adequate ventilation is the best way to avoid hazards from smoke and fumes.

Hazards from chemicals

Chemicals are involved in all kinds of soldering, and proper precautions should be taken in their handling and use.

Muriatic (hydrochloric) acid which is commonly used in fluxes and cleaners can produce chemical burns on the skin. Milder acids may produce a less serious irritation. Zinc chloride may produce severe burns and dermatitis if allowed to remain on the skin.

Prompt washing is recommended to reduce the effects of chemicals on the exposed skin. Safety goggles will protect the eyes from chemicals.

Other hazards

Keep the hoses, tips, and regulators, used with air-acetylene equipment, in good condition. Replace worn or damaged hoses or splice with an approved splicing fitting. Keep hoses away from heated metal and sources of damage and abrasion. Test connections for leaks with soapy water. Examine hoses for leaks periodically. When the hose contains gas pressure, dip it in water, and look for the bubbles that indicate escaping gas.

Do not drop tanks or handle them roughly. Do not use tanks as a roller. Use a valve wrench to open or close the valve, not pliers.

11. Shop and Laboratory Applications

1. Demonstrate how a piece of #6 copper wire, coated with an ordinary film of oxidation, will not "tin" when dipped in a solder pot without the use of flux. Scrape a spot on the wire with a knife and dip this portion in the molten solder and notice how effectively this clean place is "tinned" with solder. Flux the wire and notice the effect of flux on "tinning".

2. Demonstrate a cold joint, made on a pigtail splice in electric wiring. Heat the solder dipper and allow it to cool. Just before the solder reaches the plastic stage, dip the splice into the soldering dipper. The solder will usually form a large lump on the twisted splice.

3. Prepare zinc chloride flux by pouring some muriatic acid (HCL) into a heavy, dry, glass jar or beaker. Add some

small piece of metallic zinc slowly to the acid until the acid stops bubbling and pieces of undissolved zinc remain in the jar. The fumes given off from this reaction are offensive and should not be breathed. They are also corrosive and will cause tools to rust that are exposed to the fumes.

4. Electric soldering irons seem to heat slowly, but if overheated the tip becomes oxidized. When working in the shop it is convenient to have a hot soldering iron ready to use without having to wait for it to heat.

Build a heater like the one shown in Figure. 18. The resistance of the lamp is in series with the iron. This reduces the amount of current flowing through the iron, thereby, preventing it from heating to its maximum temperature and overheating. When the iron is to be used, turn the switch on which takes the lamp out of the circuit. The size of lamp will depend on the size of iron used. Be sure to provide a metal holder for the electric soldering iron.

5. Tin a soldering iron by filing it to the proper shape and applying flux and solder as described in the text.

6. Complete some of the following exercises:

- A. Solder a lap joint 1/16" wide to joint two pieces of 16 ga metal (3" x 3" galv. or black metal).
- B. Sweat a 1/8" lap joint (2 pieces 3" x 3" galv. or black metal)
- C. Use the joint of a soldering iron to fill a 1/8" hole (1 piece 3" x 3" galv. metal with nail hole).
- D. Solder an aluminum lap joint (2 pieces 3"x3" aluminum)
- E. Solder a patch on a 3/4" hole (1 piece 3"x3" galv. metal and 1"x1" patch)
- F. Sweat a fitting on copper tubing (1/2" sweat to MIP adapter)
- G. Solder a terminal on a stranded electric wire (electric cord)
- H. Solder a pigtail splice (2 pieces 14 solid conductor)
- I. Form a standard electric wire into a loop and solder it.
- J. Form a stranded electric wire into a hook and solder it.
- K. Solder a pan for small engine parts.

Cutting Cold Metal

A. Cutting Cold Metals in Agricultural Mechanics

Suggested Procedure and Activities: A small exhibit of metal cutting hand tools and the use of transparencies may be helpful during the class discussion.

Transparency No. 1

I. Measuring and Marking Cold Metal

- a. The most common measuring devices and their uses are listed below:

The metalworker rule is made to measure metal. It is six inches in length and is graduated in 1/64, 1/32, 1/8, 1/4, 1/2, and 1 inch.

The framing square, try square, and combination square are important measuring devices for metal work.

Where it is necessary to use long measurements, the push-pull rule and steel tape rule are used. The push-pull rule is found up to 10 feet in length, and the steel tape rule is from 25 to 100 feet in length.

If a high degree of accuracy is needed in measuring metal, a micrometer may be used. It can measure to the thousandth of an inch. Calipers are also instruments for measuring metal. The caliper is usually used with a rule or micrometer since the caliper does not have dimension numbers.

- b. Marking devices for metal are as follows:

The combination square serves as a marking guage. It has a marker (a small steel awl with a fine point) in the head that is used to mark metal.

The scratch awl is usually used with a straight edge. Its fine needle point can be placed against the measuring tool for accuracy.

Scribers are marking tools made of high carbon steel. They are used for making lines on metal in the same way the common awl is used.

Dividers are sharpened so that either of the two metal points can be used to sit on the metal or scratch the metal. They can be used to mark circles, to mark equal lengths, and to divide circles.

The center punch is used to mark the center of a hole and to make an indentation in the metal for a drill bit.

A prick punch is sharp and pointed (15 degree angle to its center). It is used in layout work by locating hole center, marking reference points, and marking lines. Paper patterns can be placed on metal and the pattern transferred to the metal

stock by piercing the paper as necessary.

2. Cutting Stock

- a. Hack Saw - Hack saw frames will usually take blades from 8 to 12 inches in length. The blades are available with 19, 24, and 32 teeth per inch. They are 1/2 inch wide and .025 inches thick.

Suggestions for using blades are:

When cutting mild steel or cast iron over 1/8 inch thick, use a coarse blade (18 teeth per inch).

Hard steel, pipe, and heavy sheet metal can be cut with a medium blade (24 teeth per inch).

Thin sheet metal and tubing should be cut with a fine blade (32 teeth per inch.)

High speed blades are usually not necessary for ordinary work. A high-carbon or tungsten-alloy blade is gough enough to resist breaking and does most jobs of a hacksaw. The high carbon blade is less expensive than an alloy or high-speed blade.

Transparency No. 2

Steps for inserting the blade are:

The blade is placed in the frame with the teeth pointing away from the handle.

Tighten the blade in the frame; the proper amount of tension will prevent the blade from snapping.

Retighten the blade after it has been used for a short time.

The steps to follow in making the cut include:

Mark the metal to be sawed and place it in a vise. The mark should be placed near the jaws, especially if the metal is thin. It may be necessary to use boards between the vise jaws to prevent scarring the work. Mark over the original mark with a file.

Hole the saw with both hands and start the cut by pulling it toward the body (backward stroke). The kerf may be started without filing a notch on the metal. As the saw is pulled backward a very small amount of pressure should be applied.

The right amount of pressure should be applied as the saw is pushed forward. No pressure should be used on the back stroke after the saw begins cutting.

Steady strokes from 40 to 50 per minute are considered the correct speed for sawing.

Never start a new blade in an old cut. The teeth are set; therefore, the cut is narrower than the new blade. One stroke may ruin the teeth.

- b. Cold Chisel- There are four common types of cold chisels used for cutting metal: standard flat, diamond point, cape, and round nose. The most commonly used is the standard flat chisel. It is used to cut sheet metal, bolts, nuts, rivets, and rods. The diamond point chisel is used for cutting triangle grooves or for making square corners in grooves. The cape chisel is used to cut out rectangular grooves or channels. The round nose chisel is used similarly to the diamond point in that oval grooves or channels can be made by its use. It cuts an oval groove.

The steps in cutting flat metal are:

Mark the metal with an awl, soapstone, scribe, or chalk.

Metal $\frac{1}{8}$ inch thick or less can be placed in the vise and cut with a flat chisel by holding the chisel at about a 60 degree angle. The cutting line should appear just above the jaws of the vise.

Place the chisel at one side of the metal to start the shearing point; at the same time place the cutting edge at an angle to the work. Drive the chisel with a machinist's hammer. Use entire hand to hold chisel firmly.

For metal that is thicker than $\frac{1}{8}$ inch, a $\frac{3}{4}$ inch wide chisel and a 2- $\frac{1}{2}$ pound hammer should be used. Larger chisels and hammers may be used as the metal increases in thickness.

Thick metal should be placed on the cutting ledge of the anvil. First, cuts should be made on each side of the metal. The cuts are made from the side to the center.

The metal is turned over and the same cut is made on the reverse side. After the cut is completed on both sides without cutting through the metal, it may be bent back and forth until it breaks.

The steps in cutting round iron are:

After the iron is marked, it should either be clamped in a vise or held on the cutting ledge or shoulder of the anvil for making the cut.

The rod or round iron should be cut from both sides, each cut being $\frac{1}{3}$ the distance through the rod.

Bend the rod at the point of the cut by bending it back and forth across the vise jaws or over the edge of the anvil.

After some practice the chisel head can be hit with heavy blows without hitting the hand. The

chisel should be grasped above the bevel and held loosely in order that the hand will not be endangered if the hammer slips off the chisel head.

The standard flat chisel is sharpened at about a 70 degree angle. Soft metals and sheet metals can be cut more rapidly if the chisel is sharpened to a 45 degree angle. Heavy sheet metal such as oil drums and metal water troughs can be easily cut with a slitting chisel.

- c. Bolt Cutters - One of the fastest methods of cutting round iron from about 3/16 to 3/4 inch thick is to use a bolt cutter. This metal cutting tool should be used properly; that is, the bolt or rod cutting capacity that is stamped on the handle should be observed.

The procedure for using the bolt cutter is as follows:

The rod or bolt is placed as far back in the jaws as possible; the handles are pulled together without twisting. When using large cutters, one handle should be braced against the floor. Note: Hardened steel should not be cut in the bolt cutter.

- d. Cold Cutters - Cold cutters function the same as cold chisels except for the fact that the cold cutter resembles an anvil hardy on one end and a hammer on the other end. It also has a handle which is used to keep the cutter on the metal while it is being hit with a large machinist's hammer. It takes two students to use a cold cutter, whereas one can cut with a cold chisel.

The cutting procedure is as follows:

The marked metal is placed on the anvil shoulder. The metal is cut about 1/3 of the way through on both sides. It is bent back and forth over the edge of the anvil until it breaks.

3. How to Cut Different Types of Metal

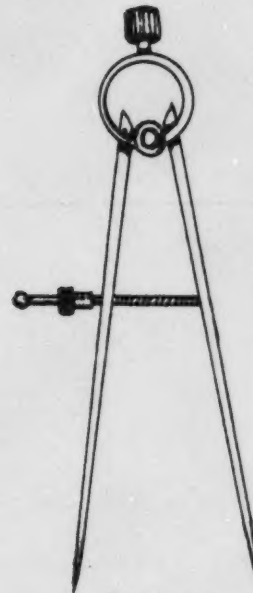
- a. Tool Steel - It is advisable to test tool steel to determine whether or not it is in the softened stage before attempting to cut it. The saw blade or chisel may be dulled if the steel is too hard. Usually tool steel is nicked with a high carbon hack saw blade. Tool steel can be broken by sawing about one-fourth the way through the rod or bar and then breaking it in a vise with the hammer. Heavy hammer blows should be directed toward the backside of the vise.
- b. Thin Metal - Very thin metal may be cut with a hack saw by placing it between two pieces of board in a vise. The cut should be made through the

boards and metal. The boards and metal can be clamped to a table top instead of being placed in a vise. Sheet metal is cut with metal snips and metal cutting shears. Snips are used very often in cutting this metal. Sheet metal of 20 guage or less can be cut with the scissor-like tool if it is soft.

MEASURING AND MARKING METAL



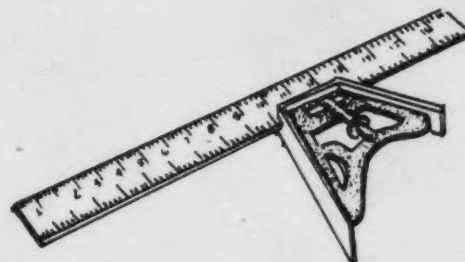
Metalworkers Rule



Dividers



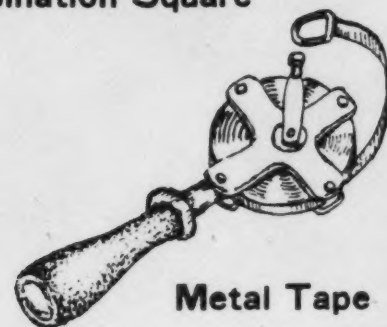
Callipers-Outside



Combination Square



Scratch Awl

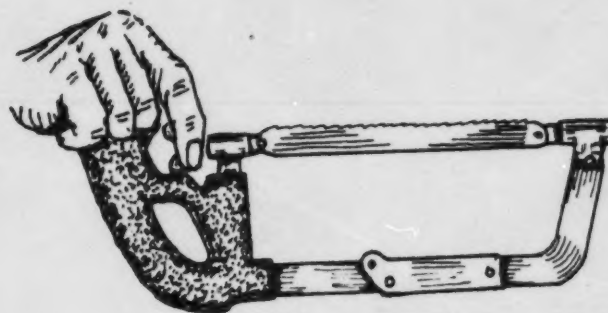


Metal Tape

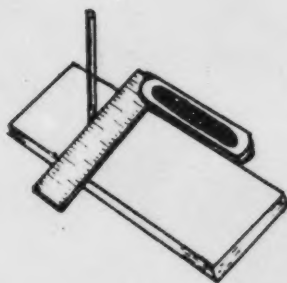
CUTTING COLD METAL WITH HACK SAW



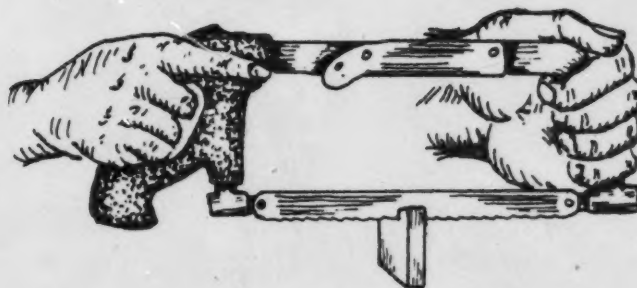
**Inserting Blade
Teeth Forward**



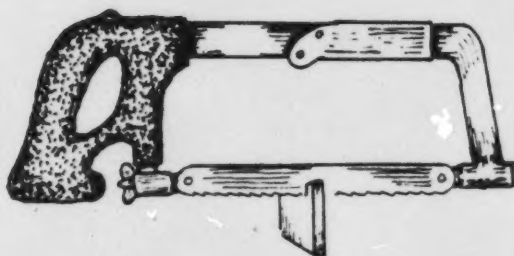
**Tighten Blade
Firmly**



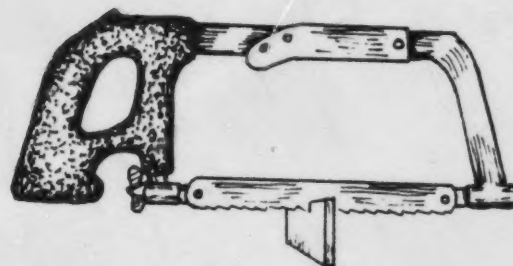
Marking Stock



Using Both Hands

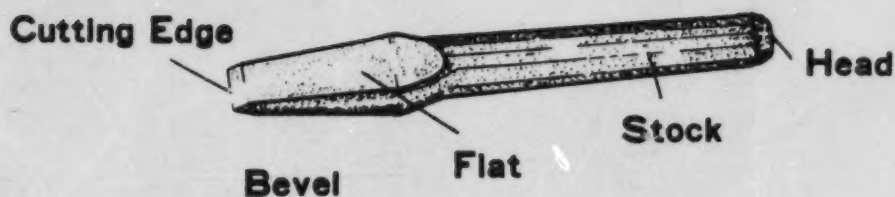


Use Pressure Forward Stroke



No Pressure On Back Stroke

USE OF COLD CHISEL



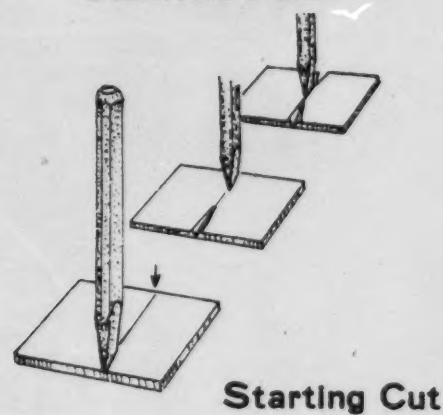
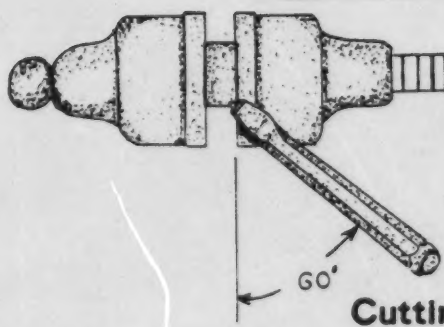
Cape



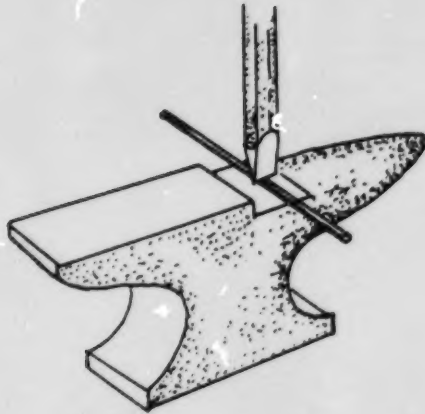
Round Nose



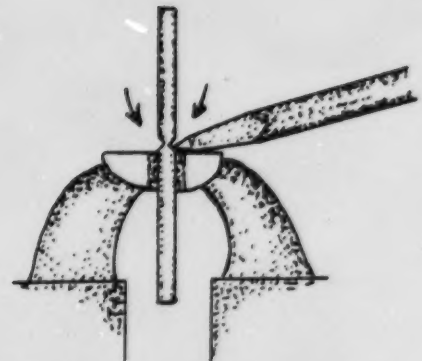
Diamond Point



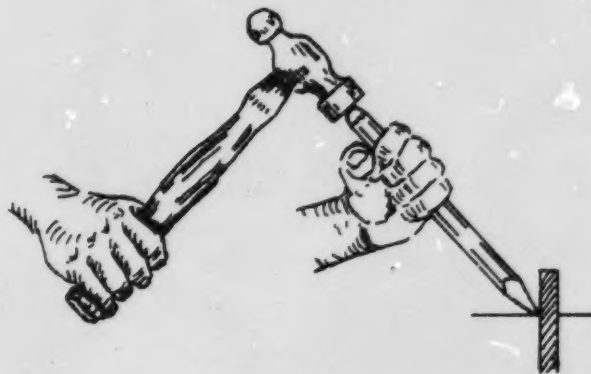
USE OF COLD CHISEL AND BOLT CUTTER



Cut Metal on Anvil Ledge



**Cut Two Sides of
Rod Before Breaking**



Use of Ball Pein Hammer with Chisel



Slitting Chisel



Bolt Cutter

Filing Cold Metal

A. Filing Cold Metal in Agricultural Mechanics

Suggested Procedures and Activities: Different types of files may be shown to the class during the discussion. Transparencies on the use of the file may contribute to the discussion.

1. The Purposes of Filing Cold Metal

- a. Shaping Cold Metal - The file is used for smoothing and shaping metals. Shaping actually includes three types of file use: sharpening of tools, smoothing metal, surfaces, and cutting metal to the desired form and dimension.
- b. Testing Metal - The hardness of metal can be determined by using a regular mill file. The degree of hardness will determine the type of metal cutting tool and/or the type of hack saw blade to use in cutting operation.

2. Selecting the Proper File

Transparency No. 1

- a. The parts of a file include:

Point	Body
Heel	Edge teeth
Tang	Belly
- b. File Sizes - File sizes are determined by the length of the file (in inches) excluding the tang or the distance from the point to the heel. A 10 inch mill file is used for general purposes. A 12 inch flat file is best for tough work.
- c. File Teeth - There are two major kinds of file teeth. The single-cut file has chisel-like teeth running at an angle across the belly and body of the file. Double-cut files have two sets of teeth or chisel cuts that cross each other. The double-cut file cuts faster than the single-cut file, but it leaves a rough surface.

Transparency No.1

Grades of Coarseness in Files - The six grades of coarseness include:

Rough	Second-cut
Coarse	Smooth
Bastard	Dead-smooth

The most commonly used files are the bastard, second-cut, and smooth. File coarseness is determined by length. For example, a 10 inch smooth-cut is coarser than a 6 inch second-cut.

Transparencies Nos. 1 and 2

- e. File Shape - The shape or style is determined by their different uses. The most common are mill, flat, square, round, half-round, and taper or three-cornered files.

Mill files are made with only single-cut teeth. They range in size from about 4 to 16 inches. They are widely used.

Flat files are double-cut about 4 to 16 inches in length. They are tapered similar to the mill file and are widely used for surface filing.

Square files have four filing sides instead of two as found on the mill and flat files. They are used mainly for filing slots and surface filing.

Round files are usually used to file round or curved surfaces. These files are tapered from the shoulder to the point.

Half-round files have one flat side and one round side. They are always double-cut on the flat side. They can be used to file flat or curved surfaces.

Tapered files are found in many shapes. The triangel, cantsaw, and crosscut files are the most popular. The tapered files are used for filing saws. The web and pruning saw files have double triangle or diamond shaped sides. The cross-cut saw file has a round back with two flat sides.

3. The Most Important Methods Used in Filing

- a. How to Hold a File After the Tang has been Fitted to a Handle

The handle is held in one hand by placing the thumb or forefinger on top of the handle and gripping the handle firmly with the fingers.

The other end of the file is held between the first two fingers and thumb, applying light to moderate pressure as needed. If heavy pressure is required, the file is held by the fingers and the back part of the thumb.

The file can be held more securely if the stock is clamped in a vise to accomplish better work. Vibration may damage the file teeth. If there is a possibility of the file slipping off the stock and marking or damaging the jaws of the vise, the stock should be clamped between two pieces of board.

- b. Steps to Follow When Using a File

The stock (metal) should be clamped slightly above the jaws of the vise to eliminate vibration while filing. The area to be filed on the stock should be about elbow height. Chattering can be

eliminated if the stock is placed near the jaws of the vise.

The proper file should be selected to cut the stock. For example, if the surface is to be filed flat, a flat tile should be used.

Usually the best position to file a stock is to stand at one side of it. Stand facing the work so that pressure can be applied on the forward stroke.

For flat surface filing the metal should be stroked by holding the file at a 90-degree angle to the side of the stock.

Make a slow full-length stroke by placing the file point on the stock and push it forward; lift it on the back stroke. Moving the file back and permitting it to slide over the metal will dull the teeth faster than pushing the file forward. About 30 strokes per minute is the proper speed to file metal.

Long surfaces can be kept flat if the filing is done diagonally on the stock. The work should be checked during the filing process with a proper type of square to see if a desirable cut is being made. A T-velel square can be used to check the accuracy of square (90 degrees) stocks.

Transparency No. 3

c. A Fine Finish is Made on the Surface by Drawfiling

After the stock has been clamped high enough in the vise to clear the fingers, each end of the file is grasped and the file is placed on the metal nearest the body. Use a mill file for drawfiling.

Steady pressure is applied as the file is pushed forward. No pressure should be applied to the file if it is dragged back over the work. Actually, when drawing the file is pushed sideways for cutting.

Hold the file flat while the moderately slow strokes are being made on the stock.

Use a wire brush to keep the file t4eth clean. The file may be partially cleaned by tapping it on the work bench. The file length can be used by using a different place on the file for each forward stroke.

d. A Method of Testing Metal for Hardness - The metal stock is held firmly as the file is pushed forward over its surface an inch or two.

Extremely Hard Metal - The file will slide over the metal leaving the file dull and shiny. The file must be harder than the material being cut. The file should not be used on hardened steel.

Hard Metal - The file may barely cut into the metal but it is dulled if considerable pressure is used.

Medium Hard Metal - This type of metal makes up a quantity of the cutting tolls; therefore, it is filed.

Soft Metal - The file teeth bit into the metal very easily and become clogged with metal particles. Soft metal is cut very easily and does not dull the file. Very little pressure is applied while filing soft metal.

Cast Iron - An old file should be used to cut through the counter surface before using a new file. The outer surface of cast iron is considered hard. If scale is present, it should be removed with a chisel and hammer before attempting to file the surface.

Transparency No. 3

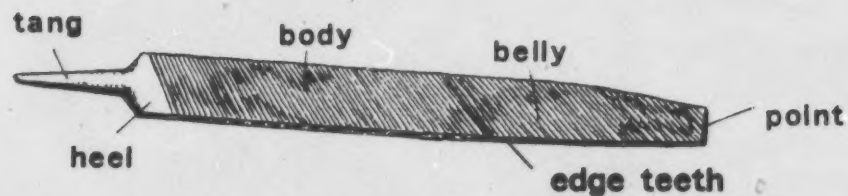
4. Cleaning and Care of the File

- a. Cleaning the File - Small metal chips clog the teeth of a file at the time it is pushed over the metal surface. These small chips tend to scratch the surface being filed, thus the process of cleaning should be followed during and after the filing job is complete. Small particles of metal are more easily removed if the file is rubbed with chalk before filing. This is a practice to use when filing soft metals. A regular file card (brush) is used to clean the teeth. Brushing should be parallel to the teeth.

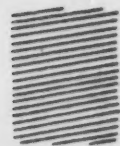
Transparency No. 3

- b. Care of the File-Files should be stored in racks away from other metals. If they rub or fall against other files and tools, the teeth will be damaged. Files are very brittle and may be broken if allowed to fall on concrete floors or other metals. They should also be kept away from oil and paints due to these materials clogging the teeth. Most files should be stored in a dry place; moisture may cause the file to corrode.

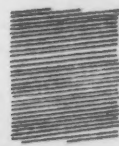
SELECTING FILES



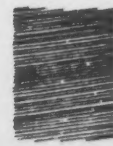
SINGLE CUT TEETH



bastard cut

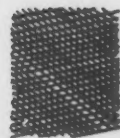


second cut

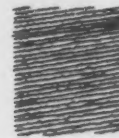


smooth cut

DOUBLE-CUT TEETH



bastard cut

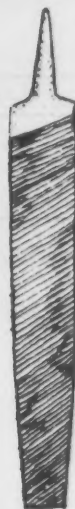


second cut

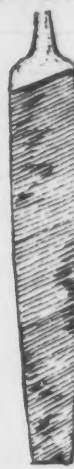


smooth cut

TYPES OF FILES



mill



flat



square

SELECTING AND USING FILES



round

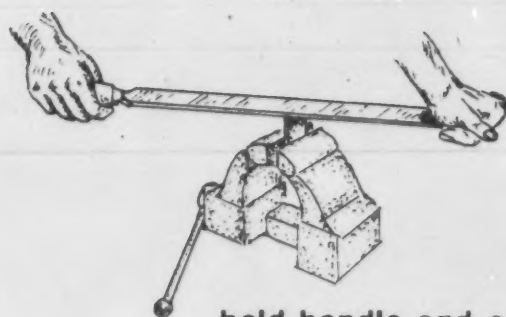


half-round

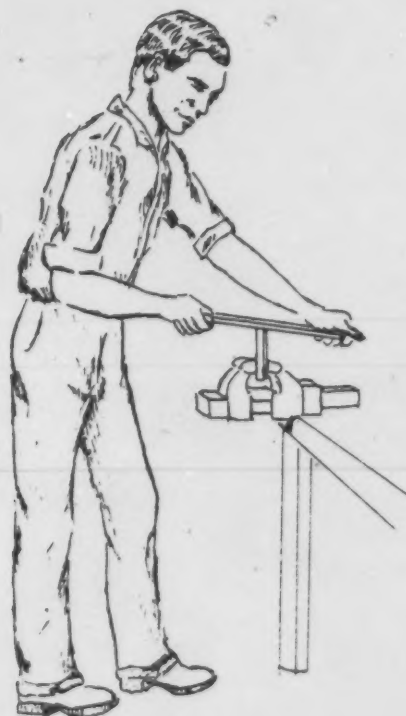


tapered

position for filing



hold handle and end
firmly-heavy work



Bending and Shaping Metal

A. Bending and Shaping Metal in Agricultural Mechanics

Suggested Procedures and Activities: The transparencies may be helpful during the class discussion. Part or the hour allotted to the lesson may be used as demonstration time.

1. Purpose of Bending Cold Metal

- a. Much of the ornamental iron work is accomplished through working with cold metal. There are numerous projects that can be made in the agricultural mechanics shop by bending and shping cold metal. Some of these projects are braces for farm equipment, gate and door hardware, shelf framing and supports, metal projects requiring ornamental design, and hardware for truck and trailer beds.
- b. Flat iron and bars can be bent and shaped up to 3/8 inch in thickness without heating. Round iron can be bent up to about 5/8 inch in diameter. Thick metal, both flat and round iron, should be heated before bending. It takes less physical strength to bend and shape hot metal than cold metal. If the metal is too thick, or too hard, extra strees is placed upon the vise, jigs, and other equipment used to shape it. Good judgment, therefore, must be used in determining whether or not heat is necessary for shaping the metal.

2. Tools Necessary for Bending and Shaping Metals

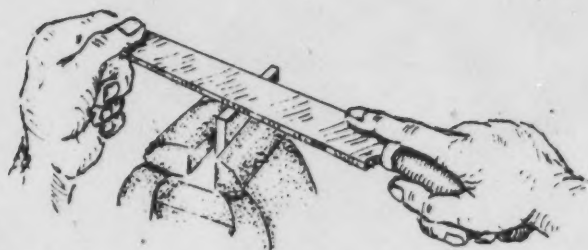
- a. The most common tolls used to shape cold metal include:

Blacksmith's vise	Sledge hammer
Machinist's vise	Blacksmith's hammer
Anvil	Machinist's hammer
Bending jigs	Monkey wrench
Measuring tools	Marking Tools
Piece of pipe and rod	Ball peen hammer

- b. Tools for shaping metal may be of different size. Flat iron less that 1/4 inch thick can be bent with a 1-1/2 pound hammer very easily, but when the iron exceeds 1/4 inch in thickness, a 2-1/2 pound hammer may be necessary to shape the metal. It is very important to use the proper size jig; otherwise, it may be damaged if the metal exceeds the size recommended for the jig.

Generally, metal bending should be a type of work that requires the use of heavy duty blacksmith's or machinist's vises. The sledge hammer should not be used against a vise, and it should not be used on the anvil if the weight exceeds the weight of a heavy machinist's hammer. Heavy duty monkey wrenches are preferred to light weight wrenches.

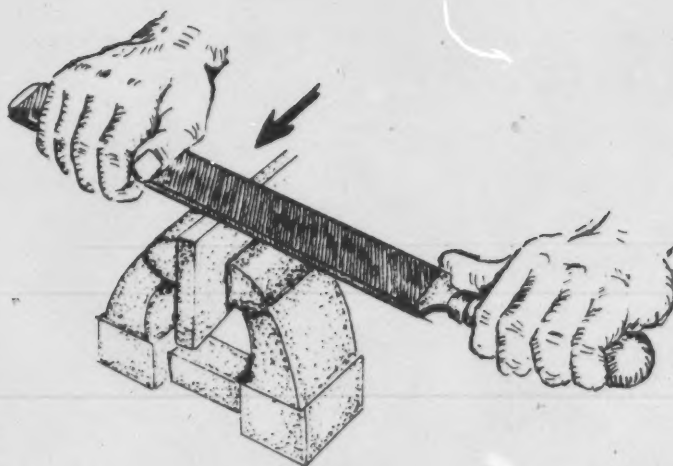
FILING PRACTICES



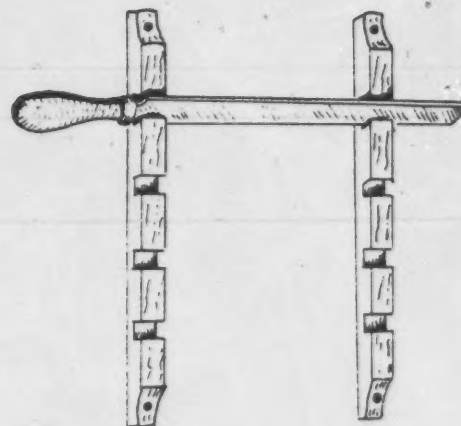
hold handle and end
firmly-light work



keep file clean



drawfiling



proper storage for files

3. The Types of Iron Used to Make Objects of Projects

- a. Flat iron that is used for making objects or projects by bending or shaping is usually black mild steel. It cannot be hardened due to its low carbon content. It may be known as blacksmith's steel, soft iron, and machine steel. It can be found in various widths and thicknesses.
- b. Round iron, which is more commonly known as rod steel or rod iron, and square rod iron or bar shaped iron of the mild steel type is bent in similar way as flat iron for objects or projects.
- c. Angle iron is molded into the angle for to give it strength; therefore, it is bent in a shop to form corners. Much of the angle iron is made of mild steel, although some angle iron is made of wrought iron.

Wrought Iron - This is a tough malleable steel that can be bent and shaped in the same way as mild steel. In fact, flat, round, and bar wrought iron is used to make objects and projects in Agricultural Mechanics.

Transparency No. 1

4. How Metal is Bent and Twisted

- a. The procedure for bending metal is listed below:
 Measure and mark the place for bending or shaping.
 The metal is placed between metal fillers in the jaws of a heavy duty vise. The fillers are to protect the metal from being marred, a practice that is not always necessary.
 Use a ball peen or machinists' hammer to bend the metal to the desired angle. Metal should be bent from the top of the vise.
 Check the degree of angle with a try square, T-bevel, or a template during the operation.
 Make a round bend (an eye) by following the steps listed below:
 Select a piece of round stock (pipe or rod) the same diameter as the eye desired.
 Place the flat metal and round stock in the vise. The flat metal should extend at least half way the distance of the diameter of the round stock.
 Bend the metal over the round stock which is level with the vise jaws by aid of a hammer.
 Extend the bent end of the flat stock to the bottom and center of the round stock and repeat the bending step.
 Place the end of the U-shaped stock at the top edge of one vise jaw and repeat the bending step

for the third time. Each time the flat stock is placed in the vise, the straight part should be parallel to the vise jaws.

If the straight part of the flat stock is bent, the stock is placed parallel to the inside of the vise jaw before bending. A hammer must be used in the first three bending steps.

b. The procedure for twisting metal is given below:

It is necessary to select metal stock longer than the exact measurement needed because twisting shortens the stock. Cut the stock to the proper length after it is twisted.

Clamp the bar or flat iron in the vise between two metal fillers. The two ends that are free of the twist should be held by the vise and wrench at the same distance from where the twisting will begin.

Use a monkey wrench to twist the flat or bar metal the desired number of turns. Proper twisting will give the metal strength, whereas excessive twisting will cause the metal stock to be weaker.

When twisting long metal stocks, a close fitting piece of pipe slipped over the stock will prevent it from bending. The pipe should be the length of the twist.

Transparency No. 2

5. Bending and Shaping Metal According to a Drawing or Pattern

- a. Metal ends are usually shaped with a hammer and anvil, plus the use of a file or grinder. To flatten the ends of flat iron, the metal end is placed on the anvil face, and the end is shaped or flattened with a ball peen hammer. If the metal is to be decorated, the peen part of the hammer should be used on the end, or any place on the flat surface. The ends should be shaped before the metal is placed in a vise or jig. The end shape may be drawn on an actual size drawing or pattern.
- b. A pattern or actual size sketch is very important to the student when using jigs or bending tools. The steps are as follows:

Use a piece of string or copper wire by starting at one end of the drawn object and follow the pattern through curves and bends to the opposite end. This method of measurement will determine the length of metal needed.

If necessary, the ends should be shaped and peened. The end bend should be started on an anvil.

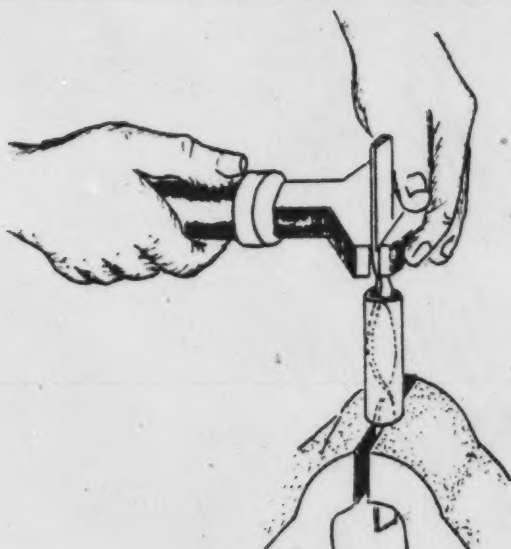
The bending fork or jig should be placed in a vise and secured firmly.

If the posts are adjustable on the jig, they should be adjusted to the thickness of the stock to be bent.

The curves and angles are formed with the bending jigs or forks by use of the hands, pipe, and hammer. Sometimes it is necessary to slip pipe over the iron to give extra support for applying pressure. Usually, stock that is more than 1/4 inch thick must be bent in a vise.

The object or project should be checked frequently by placing it over the drawing. If a bend is too short, a vise may be used to straighten it.

BENDING AND TWISTING METAL



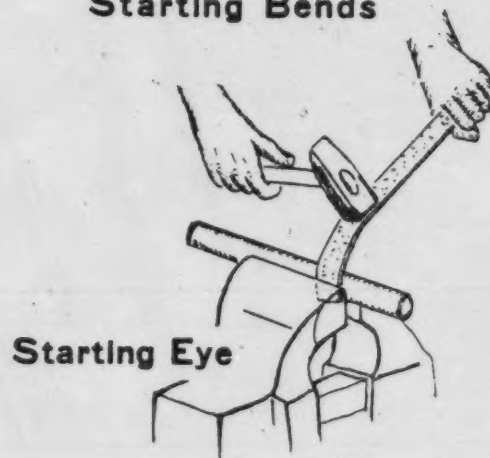
Making Long Twists



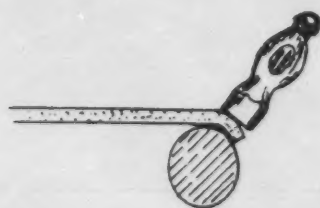
Use of Hammer Starting Bends



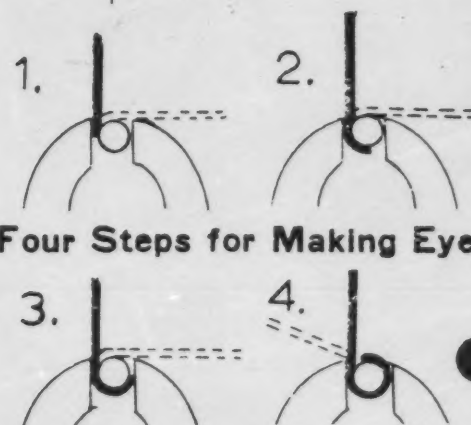
Use of Pipe to Start Bend



Starting Eye



Starting Eye on Anvil Horn

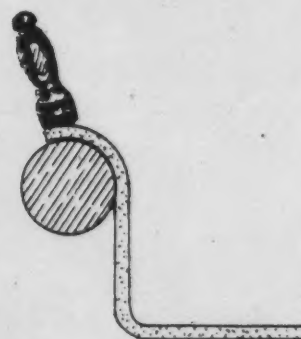


Four Steps for Making Eye

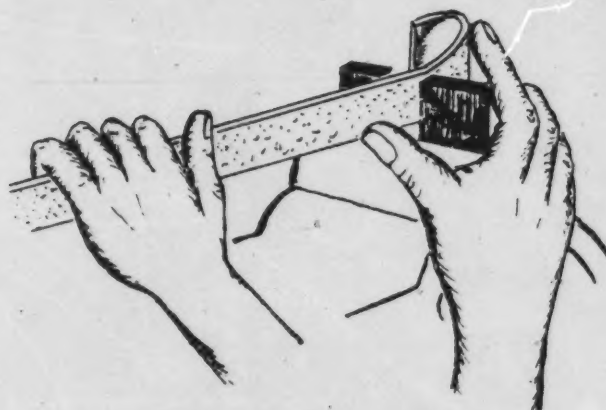
BENDING AND SHAPING METAL



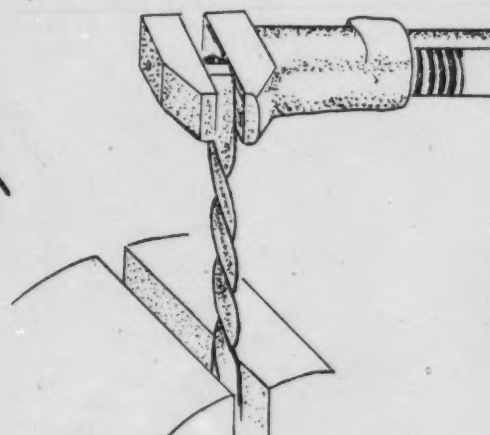
Ninety Degree Bend on Anvil



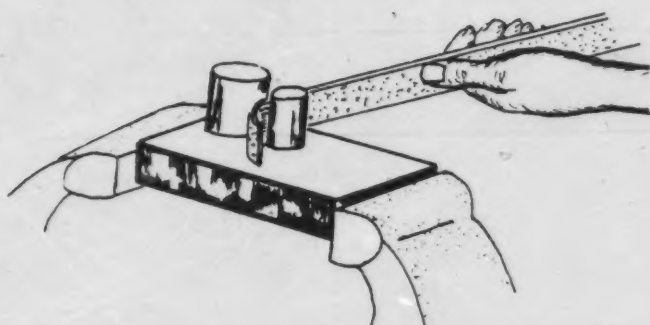
Shaping End on Anvil Horn



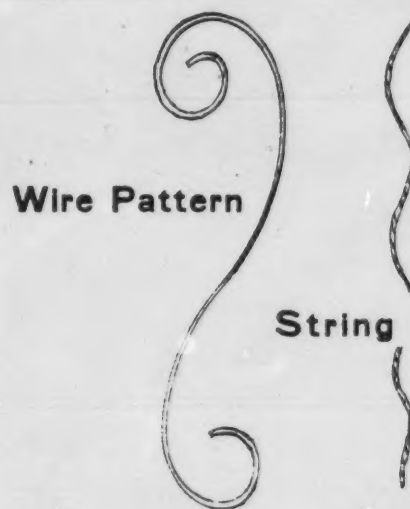
Using Metal Bending Fork



Twisting Square Rod



Using Jig to Bend Metal



Wire Pattern

String or Wire

Laying out Designs

TOOL FITTING

OBJECTIVES

Upon completion of this unit, the student should be able to:

1. Use a dresser to dress a grinder wheel.
2. Safely and properly fit a cold chisel, wood chisel, screwdriver, plane iron, metal drill bit or wood auger. (Instructor and/or class should decide which skills are of highest value; select the two most appropriate.)
3. Identify correct use for tools being fitted.
4. Identify abuse of tools being fitted.

Projects

1. Use old drills and/or augers for sharpening - secure old drills and/or augers from the agriculture shop, other school shops, shops and businesses downtown, farmers of the community, or students bring their own.
2. Cold chisels - sharpen cold chisels from the sources identified above and return them sharp and/or cut 8-10 in. pieces of 1/8 x 2 flat stock and have students fit it as though it were a chisel.
3. Plane irons and wood chisels - secure from sources identified on #1 above and return them sharp and/or cut 8-10 in. pieces of 1/4 x 1/2 flat stock and have students fit it as though it were a screwdriver.

*NOTE: Instructor and/or students select two tools to fit as deemed important to local area, use others as activities for students who finish early for a one week unit. If tool repair is not desired to fill second week fit four tools.

Instructor Activities and Teaching Suggestions

1. If there are more than 15 students in the class get an aide (junior or senior student who is skilled in mechanics).
2. Teach correct and safe procedure for fitting selected tools.
3. Demonstrate correct and safe procedure for fitting selecting tools.
4. Supervise students as they work.
5. Students must pass a safety test on grinders with 100 percent accuracy to work on these projects.

Student Activities

1. Participate in discussions and demonstrations.

2. Complete study guides if used.
3. Pass the grinder safety test with 100 percent.
4. Fit a minimum of two tools as identified by the instructor and/or class.

TEACHING OUTLINE

- A. Plane Iron, Wood Chisel, Bits (Wood and Metal), Screwdrivers, and Cold Chisel.

Suggested Procedures and Activities: Sharp tools and tools that need sharpening may be used as teaching aids during the class discussion. Transparencies should be used if available

1. The Grinding Wheel

- a. The grinding wheel is one of the most important pieces of equipment in the shop. If the wheel is used properly, it remains free of soft materials such as wood, rubber, aluminum, brass, copper, bronze, lead, tar, paint, and clay materials. A wheel that contains one of more of these materials usually becomes glazed. Another important feature of a conditioned grinding wheel is its squareness across the face.
- b. In order to restore the wheel to the desired working condition it may be necessary to remove the glazed or loaded surface with a grinding wheel dresser. The most commonly used dressers are as follows:

Huntington Dresser- The wheel is sharpened as the star-shaped cutters are held against the wheel as it rotates.

Diamond Dresser - A diamond set in the end dresser removes grains of abrasive as it is held against the wheel.

Diamond-Carbon Dresser - A hard abrasive held in the tube removes particles from the rotating wheel as the dresser pressure is applied to the wheel.

Abrasive Stick - A grinding wheel is dressed or tuned when an abrasive stick or an old piece of a grinding wheel is pressed squarely against the wheel.

2. Proper Grinding

- a. Grinding of sides of the wheel can be successful if a special side grinding wheel is used, otherwise the shape of the wheel may be spoiled and the edge tool burned.
- b. Hollow grinding is recommended for all hand tools and knoves.
- c. It is recommended that a tool be moved back and

forth over the wheel to prevent heating. High speed steel tools may overheat while grinding. They should not be dipped into cold water for chilling. High speed steel often cracks when dipped in cold water.

- c. It is recommended that a tool be moved back and forth over the wheel to prevent heating. High speed steel tools may overheat while grinding. They should not be dipped into cold water for chilling. High speed steel often cracks when dipped in cold water.
- d. Some tools are not usually sharpened by using a grinding wheel. Regardless of the method employed to properly grind tools such as small knives, scissors, divider points, ice picks, awls, and many other small tools; there is always a possibility of destroying the temper in the point or cutting edge.

3. A Comparison Between Conditioning a Plane Iron and a Wood Chisel

- a. A plane iron is mounted in a frame so that the depth of cut can be controlled and even pressure and movement can be applied; otherwise, it is similar to the wood chisel.

- b. The plane iron and the wood chisel are similar in the following ways:

The grinding and wetting are done on one side only.

The bevel length is twice the thickness of the blade or iron.

An angel of 25 to 30 degrees is considered standard.

The blade should be kept sharp at all times and used correctly on wood.

- c. The major difference in sharpening a plane iron and wood chisel is the rounding of the corners or the blade edge of a plane iron. Wood chisel corners are left square. Square corners on a plane iron may leave grooves, especially if the board is wider than the blade.

4. How to Determine When to Sharpen Plane Irons and Wood Chisel Blades

- a. A close check of the iron or blade may reveal the following conditions:

The tool is dull and only needs wetting.

Nicks are found in the cutting edge.

The cutting edge is not square.

The concave bevel has been honed away causing a need for grinding the tool.

Medium bevels are considered to be about 1/4 inches long, which may be too short for parting and too long for mortising.

Blue spots (over-heated areas) may appear near the cutting point, revealing that areas have been burned and have lost their original hardness.

The plane iron may have square corners, and the wood chisel may have round one.

- b. Another easy way to determine when there is a need to sharpen the tools is the quality and quantity of work being done. More time is required to complete a project with dull tools than with sharp tools. Also, there is a better quality or workmanship on the project if sharp tools are used.

Transparencies Nos. 1 and 2

5. Grinding and Honing the Wood Chisel and Plane Iron

- a. Steps for jointing plane iron are listed below:

Place the iron or blade on the tool rest with the bevel pointing up.

While holding the iron bevel on the tool rest, touch it very lightly against the wheel and move the iron from left to right until the nicks are removed.

Check the edge for squareness.

- b. Grinding a blade or iron is accomplished in the following manner:

Use a flat tool rest and adjust to proper angle for grinding the blade or iron at 25 to 30 degree angles.

Grind the chisel blade to an angle slightly shorter or slightly longer than 1/4 inch, depending on the type of work to be done. A plane iron bevel is about 3/16 inch long.

While grinding a blade or iron, lay it flat on the adjusted tool rest, and move it from side to side, keeping it perpendicular to the face of the wheel. Grind until a wire edge appears on the flat side.

Dip the blade or iron in water occasionally to keep it cool.

Check the blade or iron frequently for squareness by using a try square; use a template to determine the correct angle of the bevel. The angle (25 degrees) can be obtained by setting a T-bevel on the numbers 3 and 6 of a carpenter's square.

- c. Hone the blade or iron by using the following steps:

Put the final finish on the cutting edge by honing it on an oilstone. Use a few drops of oil before laying the flat side of the blade on the oilstone to help remove the wire edge; reverse the position and hone the angle until the wire edge disappears.

After the wire edge is removed, the bevel is placed against the oilstone. To adjust the desired angle, rock the blade or iron back and forth until the angle is flat on the oilstone surface.

Move the plane iron or chisel blade in a back-and-forth motion with both hands moving parallel to the stone. Keep the oilstone surface moist with oil to prevent the fine steel particles from entering the stone's pores.

Round the plane iron edges by honing. This step is not required when honing a chisel blade.

6. Reshaping Auger Bits

- a. Auger bits should be sharpened for the following reasons:

The auger bit consists of two cutting lips, two cutting spurs, a feed screw, the twist, shank, and tang. If any cutting part of the bit strikes a nail or other metal, the part is either dulled, nicked, or bent; therefore, it is necessary to recondition the bit. Quality workmanship cannot be done with a dull or damaged bit.

A rusty auger bit will fail to cut properly if the twist is rusty. It is more difficult to use due to the friction caused by a rough surface in the twist.

Transparency No. 3

- b. Reconditioning auger bits is usually done with a file. The steps for fitting a bit are listed below:

Straighten the cutting spurs if they are bent inward or outward. The spurs can be placed on a piece of thin flat metal and tapped lightly with a hammer.

Hold the bit at a slight angle while filing the lips. Both lips should be filed at about a 25 degree angle. The lips and spurs are filed only on one side or surface, except for removing a wire edge that may be formed on the unfiled side.

Remove rust from the twist by oiling the entire bit, and polish the twist by pulling a piece of small rope through it. The outside flat surface of the twist can be cleaned by wiping it with an oily rag.

- c. Some shops do not have the bit file; therefore, a small slim taper three-cornered file may be used to sharpen a bit if the individual is careful. A standard grinding wheel should not be used to reshape auger bits.

7. Reshaping Twist Drills

- a. The reasons why a twist drill must be reshaped are:

Without proper drilling equipment many construction and repair jobs cannot be accomplished in the shop. Sharp drill bits are very important where hand drills (electric and manual) are used.

A drill bit that is dull, nicked, overheated, or sharpened improperly for specific jobs will result in inferior workmanship.

- b. Drill bits should be checked due to the following reasons:

A 12 degree clearance behind the cutting edge is necessary to allow the cutting lips to cut into the metal.

Both cutting lips must be ground the same or the point will not be centered, and the bit will produce an oversize hole.

The lips must be ground to about 59 degrees with the axis, if the bit is to cut metal properly.

The bit point should be slightly rounded from the cutting edge to the heel. Rounding the point requires skill and exactness.

Transparency No. 4

- c. The important steps to follow in sharpening a twist drill are:

Place the drill point against the grinder wheel (both point and shank at the same height). Use both hands. The drill should be held at a 60 degree angle to the wheel.

Use one hand near the bit point and wheel; raise the bit cutting point and at the same time lower the shank with the other hand during the grinding process.

Make slow strokes as the point is pushed against the grinder wheel. The drill bit should be very slightly rotated clockwise as the point is forced on an upward sweep. Dip the bit points

in water at frequent intervals while it is being ground to keep it from overheating.

Rotate the drill and grind the other lip in the same manner.

Use a template to check the proper angle after every few strokes. Also, check for a 12 degree clearance from the front of the cutting lip to the back edge (heel).

- d. The same bit can be used for hard and soft metals. Hard materials cause heavy pressure to be applied to the drill bit; a bit with an angle of more than 59 degrees will have a tendency to do less gouging. This same bit can be used on soft metals. A 30 degree angle from the central axis is considered most practical for drilling wood.
- e. Twist drills cut best when sharpened properly; therefore an amateur may prefer a drill sharpening attachment for the grinder. Free hand grinding is not difficult to learn with practice.
- f. Proper lip clearance can be determined best by holding the drill bit in a horizontal position and level with the eye. While looking at the point line formed in the center by grinding both lips, one will see that it is 45 degrees to the cutting edge. If the small center line is more vertical than horizontal the bit is lacking lip clearance.

8. Reshaping Screwdriver Tips

- a. Most agricultural mechanics shops are equipped with various kinds and sizes of screwdrivers. It is not uncommon to find several screwdrivers in a shop that need reconditioning either due to misuse or wear. A screwdriver can serve its best purpose if it is properly fitted to a certain size screw.
- b. Screwdrivers should be refitted with the tips are nicked, beveled, thick rounded, twisted, or too soft.

Transparency No. 5

c. Steps for refitting tips

A broken or worn tip can be refitted by the following procedure:

Join the end square by holding the tip at a 90 degree angle against the grinding wheel.

Shape both faces of the screwdriver by placing them flat on the grinding wheel. Carefully push and pull the handle with one hand as the other hand helps guide the tip. Only light pressure is applied during the time the blade is in contact with the grinding wheel.

Dip the blade in water several times during the grinding process to cool. Use a screw head to determine the extend of grinding desired.

Grind both sides of the tip in the same manner as grinding the faces. The tip should be placed in a screw slot during the shaping process in order to make it the same width as the screw head. The sides may be shaped parallel 1/4 inch from the tip.

Final shaping of a tip may be accomplished by using a file or oilstone.

If a screwdriver tip is twisted, it may be reshaped by placing it on an anvil and tapping the twisted part with a ball peen hammer.

Badly worn or broken tips may need retempering after they have been reshaped. The temper may be withdrawn from the blade during reconditioning, thus causing the tip to be soft.

9. Reshaping Cold Chisels

a. The two main reasons for reshaping a cold chisel

Where shops do a considerable amount of metal work, the cold chisel is an indispensable tool. It is one of several tools that cannot be used unless it remains sharp.

The cold chisel is abused in the same manner as many other shop tools; it is nicked, broken, dulled, and the head is mushroomed if used extensively. It is not the most difficult tool to reshape, but it may need reshaping more often than many cutting and punching tools.

Transparency No. 6

b. Reshaping steps are listed below:

Join the cutting edge until all nicks or gaps are removed. Hold the chisel in a level position while moving the point from side to side across the stone.

Hold the handle part of the chisel with one hand and place the chisel body against the tool rest at about a 65 to 70 degree angle with the handle pointing down.

Use the fingers or thumb of the other hand to apply pressure and help guide the point from side to side on the wheel. A slight swing of the chisel handle will give the chisel a curved cutting edge. Dip the point in water frequently while grinding it to keep it cool.

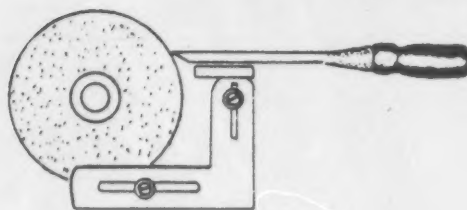
Grind both sides of the cutting edge in the same manner.

Check for the desired angle of bevel. The angle should be checked during the process of grinding both bevels. An angel guage may be determined by cutting a V $\frac{3}{8}$ inch deep and $\frac{1}{2}$ inch wide in a piece of thin metal. This template will have two 70 degree sides.

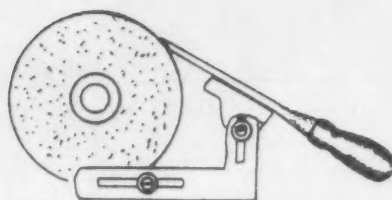
If a mushroom head is formed on the chisel, grind it off at the same time the chisel is being shaprened. Pieces of flying steel from the head may cause accidents.

If the chisel is ground to the point that it is too thick at the end, it may be necessary to heat the chisel, draw it out and retemper the cutting point.

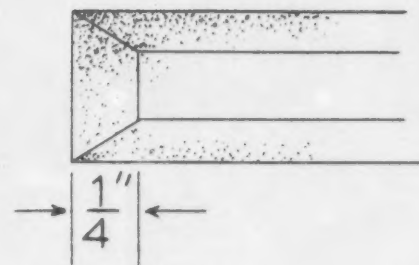
GRINDING WOOD CHISELS AND PLANE IRONS



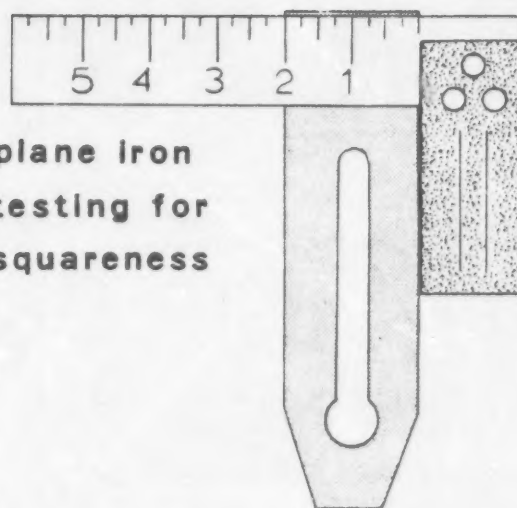
jointing a chisel



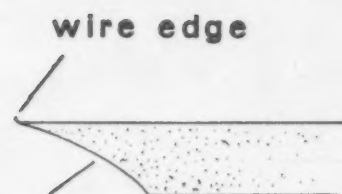
grinding chisel



chisel bevel



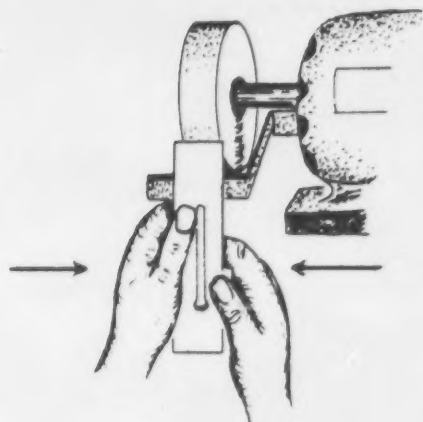
plane iron
testing for
squareness



concave bevel

plane iron

GRINDING AND HONING PLANE IRONS AND WOOD CHISELS



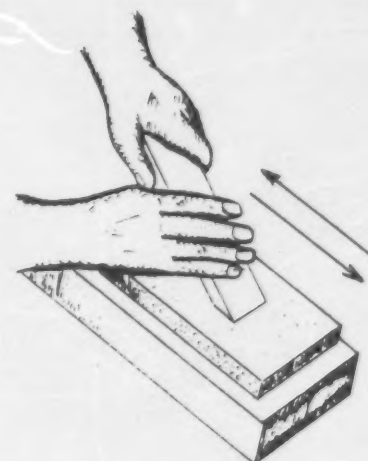
move iron from
side to side



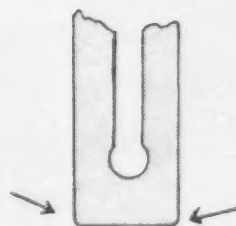
check angle of
iron on template



remove wire edge
on oilstone

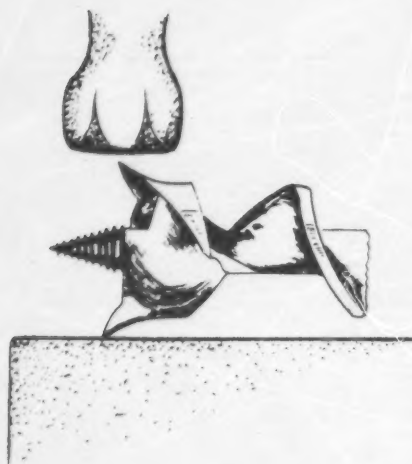


hone with back
and forth motion

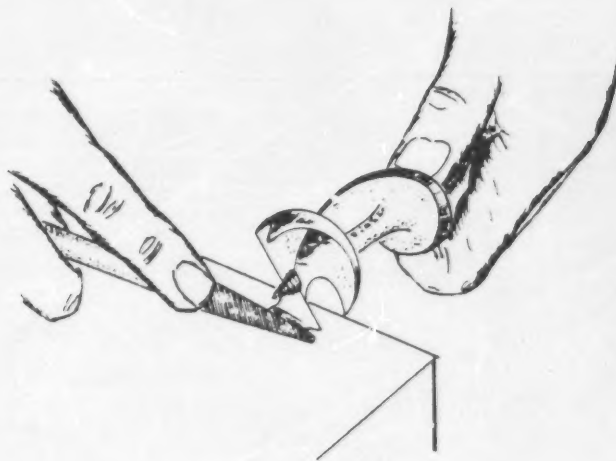


round corners
on plane iron

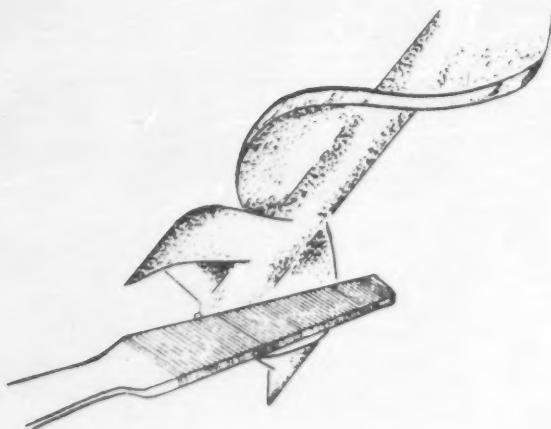
RECONDITIONING AN AUGER BIT



straighten spurs



file inside of spur



file lips at about 25
degree angle



remove rust from
twist with oil and rope

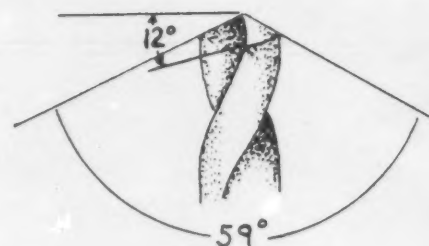
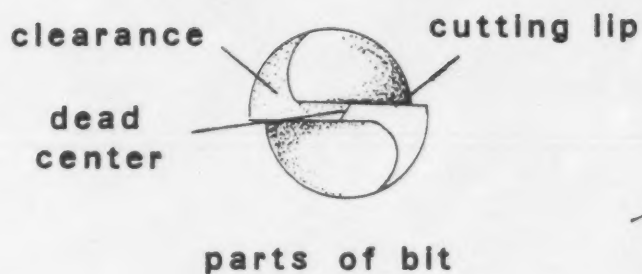
SHARPENING A TWIST DRILL



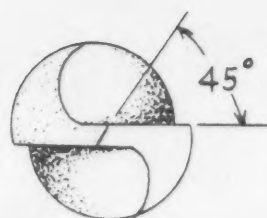
beginning sweep with drill



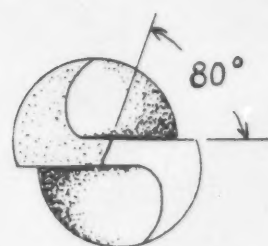
hold drill
at angle



correct bit angles



correct center point



bit lacking
clearance

REFITTING SCREWDRIVERS



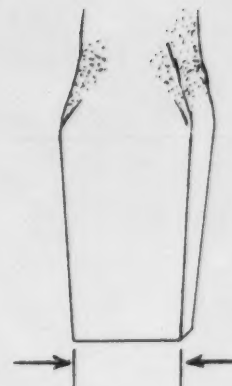
thin



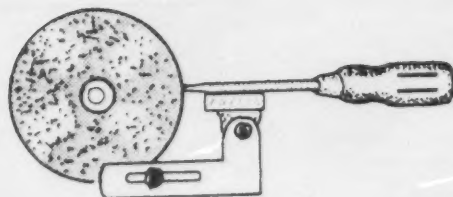
correct



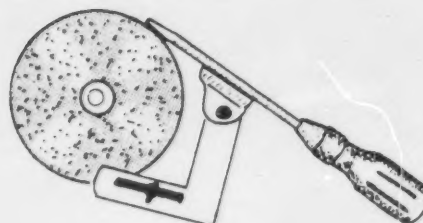
thick



width of tip



joint tip



grind tip

condition of tips



nicked

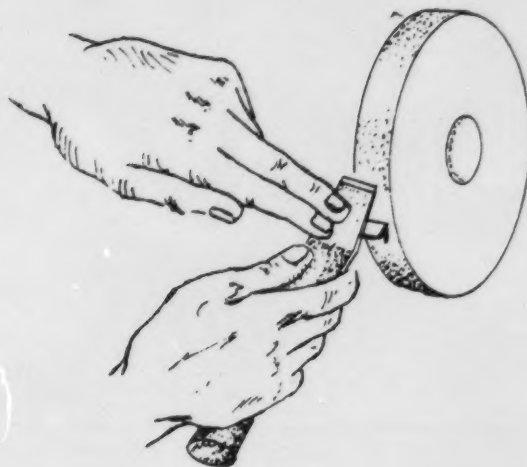


correct

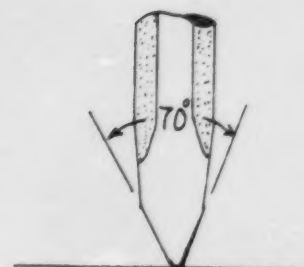


rounded

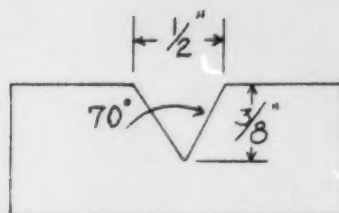
RECONDITIONING A COLD CHISEL



proper way to grind chisel



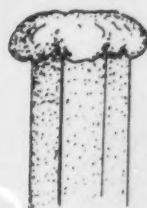
70° angle



template for cold chisel



proper bevel and rounded corners



mushroom head is dangerous

Teaching Outline

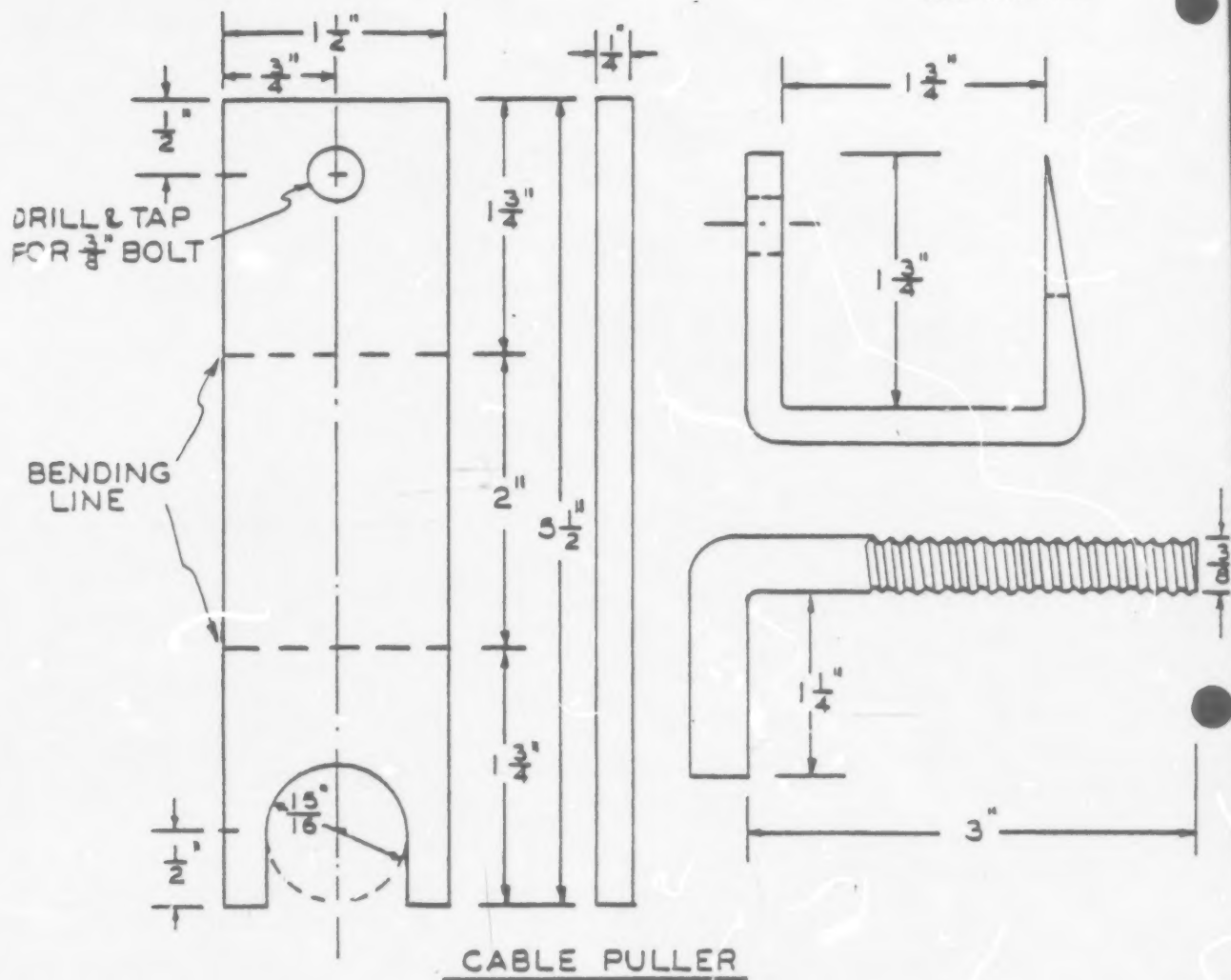
B. Repair Hand Tools

1. Have students bring a rake, hoe, shovel, sledge hammer, hammer, etc. from home to repair.
2. Have students buy appropriate handle for the tool they bring from home for repair.
3. Demonstrate cleaning of tool.
4. Demonstrate correct replacement of handle with a sample tool.
5. Allow students to clean, repaint, and replace handles---result a new looking tool.

PROJECT PLANS

The following pages contain project plans appropriate to the Agricultural I Guide-Agricultural Mechanization Unit.

Use these or other project plans as deemed appropriate to the instructional need for the region served by your vocational agriculture program.



Materials Needed

- One piece $\frac{1}{4}$ " x $1\frac{1}{2}$ " x $5\frac{1}{2}$ " hot rolled flat bar
- One piece $\frac{3}{8}$ " x $4\frac{1}{2}$ " hot rolled round bar

Procedure

1. Cut materials to length
2. Layout and mark all dimensions
3. Drill pilot hole for $\frac{3}{8}$ " - 16 N.C. tap and $\frac{15}{16}$ " hole for slot in flat bar.
4. Cut out remaining metal to form $\frac{15}{16}$ " slot.
5. Tap small hole with $\frac{3}{8}$ " - 16 N.C. tap.
6. Heat and bend at lines.
7. Grind taper on slot end.
8. Heat and bend round bar. Place 3" end in vice while bending to keep this portion straight for threading.
9. Cut $\frac{3}{8}$ " - 16 N.C. threads on round bar. Adjust die so threads fit tapped hole.
10. Remove any sharp edges or burrs with file.
11. Turn in puller and this sheet for grade. See grading scale on reverse side.

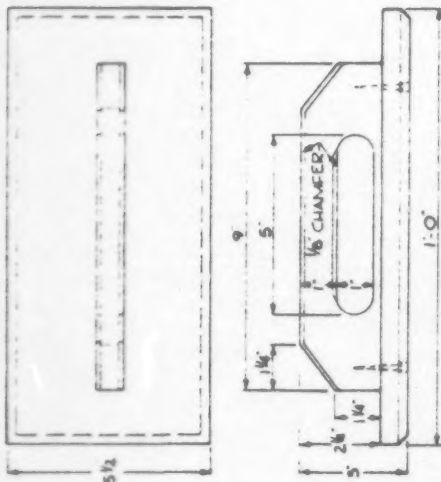
Battery Cable Puller
Evaluation Score Sheet

<u>Item</u>	<u>Points</u>	
	<u>Possible</u>	<u>Earned</u>
1. Squareness of top bend	2	_____
2. Squareness of bottom bend	2	_____
3. Size of slot	2	_____
4. Centering of slot	2	_____
5. Slope of bevel	2	_____
6. Location of top hole	2	_____
7. Straightness of top hole	2	_____
8. Fit of threads	3	_____
9. Cleanness of threads	2	_____
10. Length of handle	2	_____
11. Length of threaded portion	2	_____
12. Bend of handle	2	_____
13. General appearance	3	=====
TOTAL POINTS	30	_____

Name _____

1/2" No. 9 SCREWS
SET 1/8" DEEP

1/4" CHAMFER



1. 1 - 1" x 6" x 1" white pine or redwood board
2. 1 - 1" x 3" x 9" white pine board
3. 2 - 1-1/2" #9 FH bright wood screws
4. 1/4 pint linseed oil
5. Waterproof or water resistant glue

NAME: _____

DATE: EVALUATION:

1. Lay out and cut base to dimension.
2. Chamfer base edges.
3. Lay out and cut outside dimensions of handle.
4. Drill and cut hole in handle.
5. Chamfer edges of handle.
6. Locate handle, drill pilot holes for screws.
7. Fasten handle to board with glue and wood screws.
8. Sand float, apply one coat of linseed oil.

Ability to

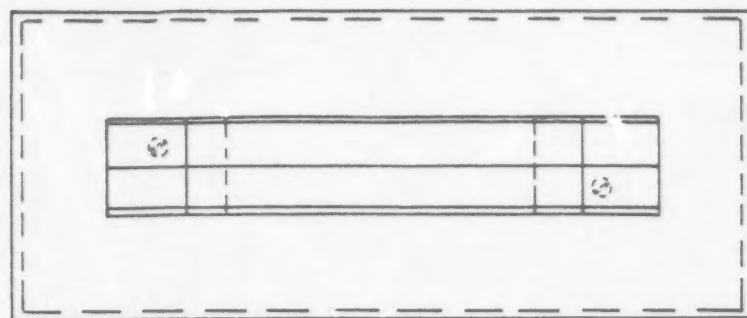
1. Measure accurately.
2. Use the table, radial arm or band saw.
3. Properly use the jointer.
4. Drill holes in wood.
5. Use the saber saw or key hole saw.
6. Use a wood chisel.
7. Select correct wood auger bit.
8. Drill pilot holes for screws.
9. Drive screws.
10. Use the electric drill.
11. Finish and treat with linseed oil.

Points

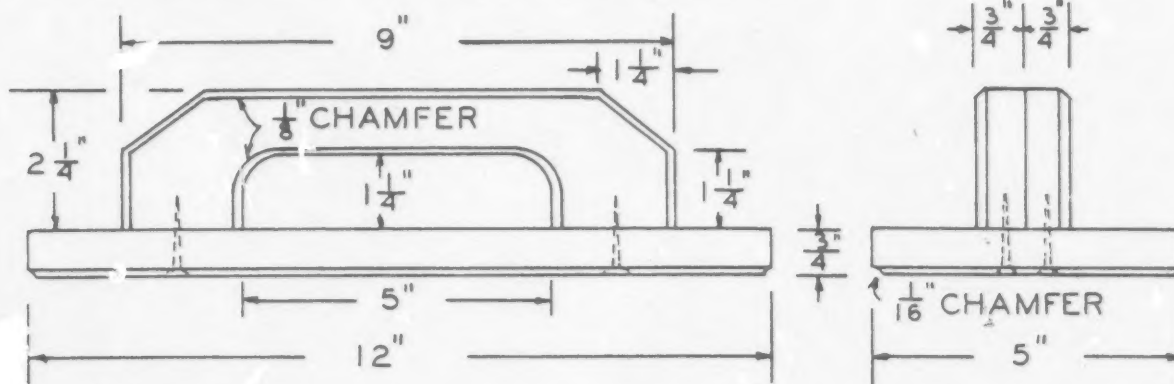
	<u>Item</u>	<u>Possible</u>	<u>Earned</u>
1.	Correct length and width of base	15	_____
2.	Base is square	10	_____
3.	Chamfers smooth, even, correct dimensions	10	_____
4.	Correct handle dimensions	15	_____
5.	Hole in handle is smooth	10	_____
6.	Handle centered on base	10	_____
7.	Screws properly countersunk	10	_____
8.	General appearance	10	_____
9.	Safety and work habits	10	_____
	Total	100	_____

1305 Tiller Lane

St. Paul, Minnesota 55112



NOTE: USE 2-1 $\frac{1}{2}$ " NO
SCREWS, COUNTERSINK



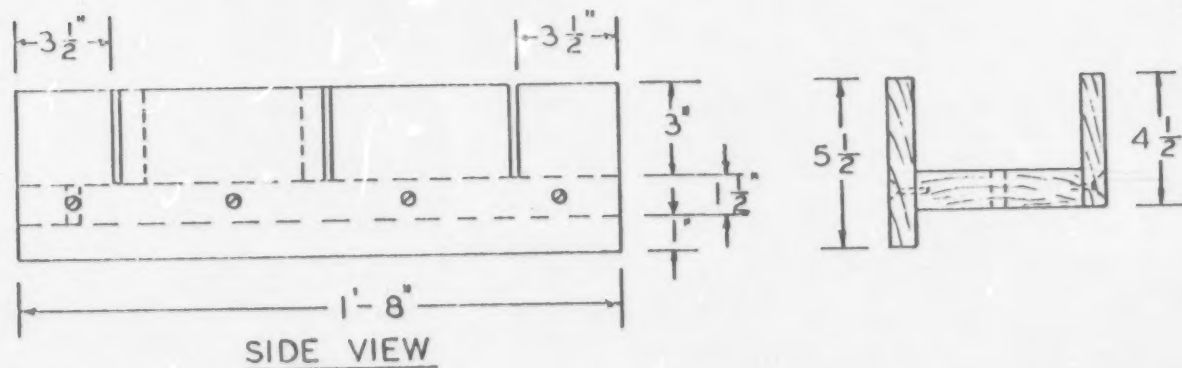
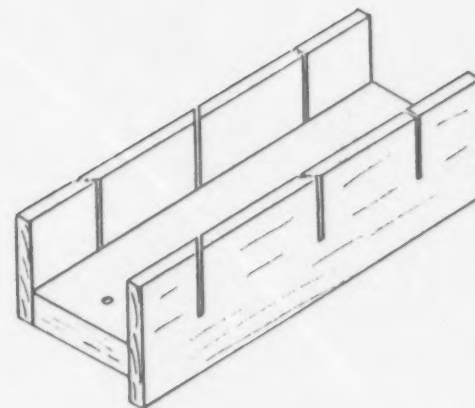
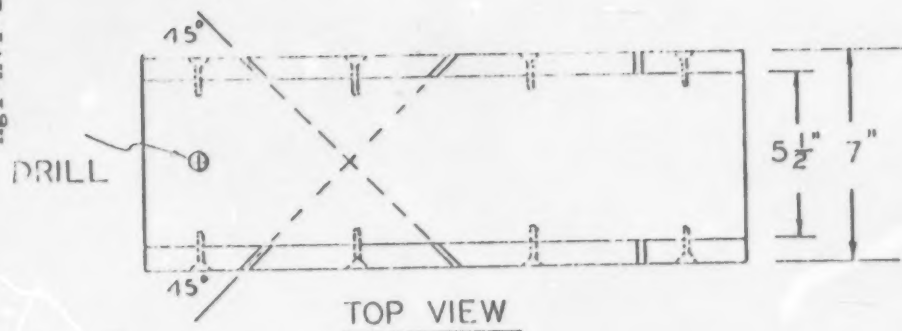
Materials - 1 - 1" x 6" x 22" white pine board
2 - 1 $\frac{1}{2}$ " #9 flat head wood screws
waterproof glue
Linseed oil

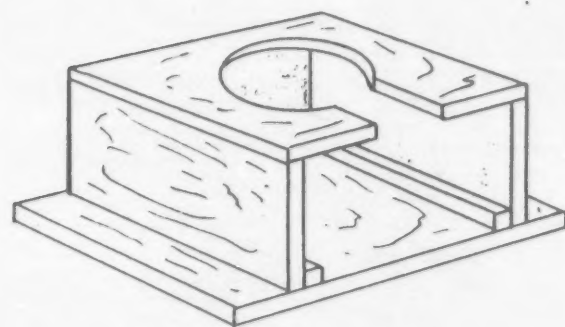
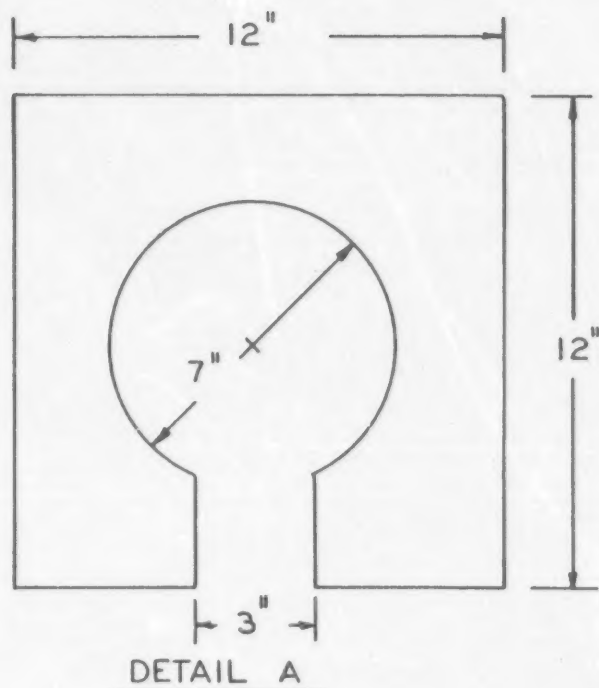
Procedure

1. Cut base to 12" with radial arm saw.
2. Rip base to 5 1/8" with table saw.
3. Narrow base to 5" with jointer.
4. Champher base with hand plane.
5. Rip handle stock to 2 $\frac{1}{4}$ " with table saw (Note - handle may also be made from 2" x 4" stock).
6. Glue handle stock pieces together.
7. Drill 1" holes to form radius of curve in handle.
8. Cut handle shape with jig or band saw.
9. Remove rough saw marks with sand paper.
10. Champher handle with chisel and hand plane.
11. Locate and attach handle to base with screws. Countersink screw heads.
12. Finish with Linseed oil.

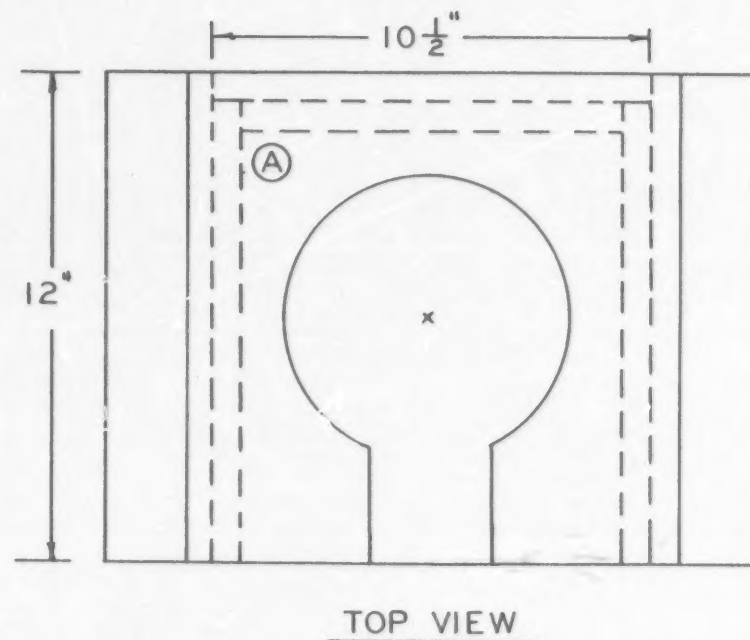
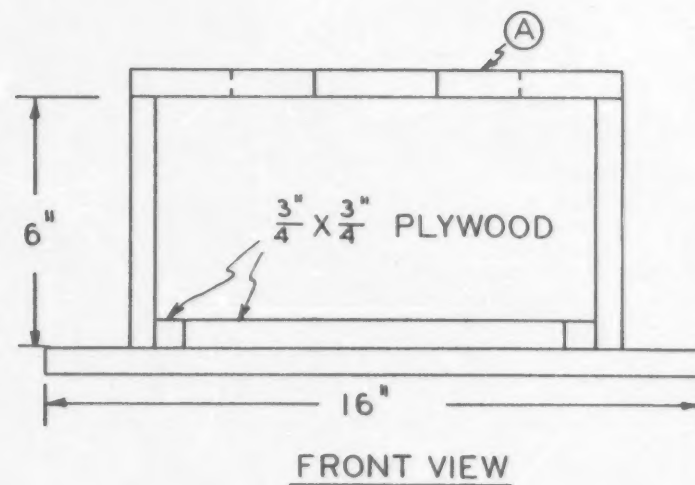
AgI-XVI-250

MITER BOX

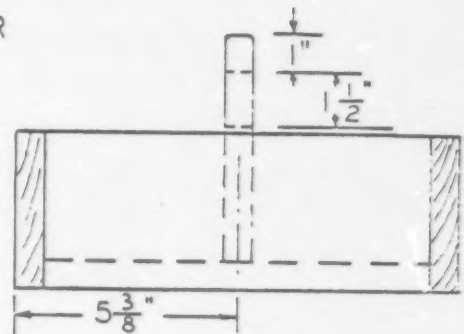
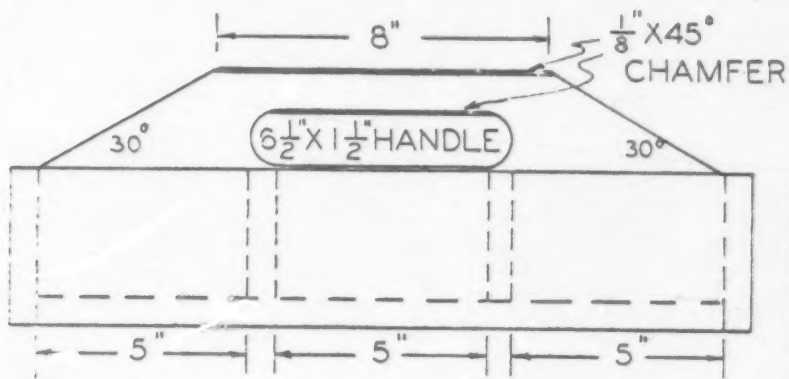
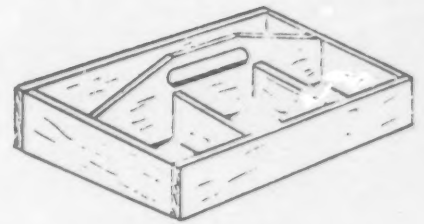
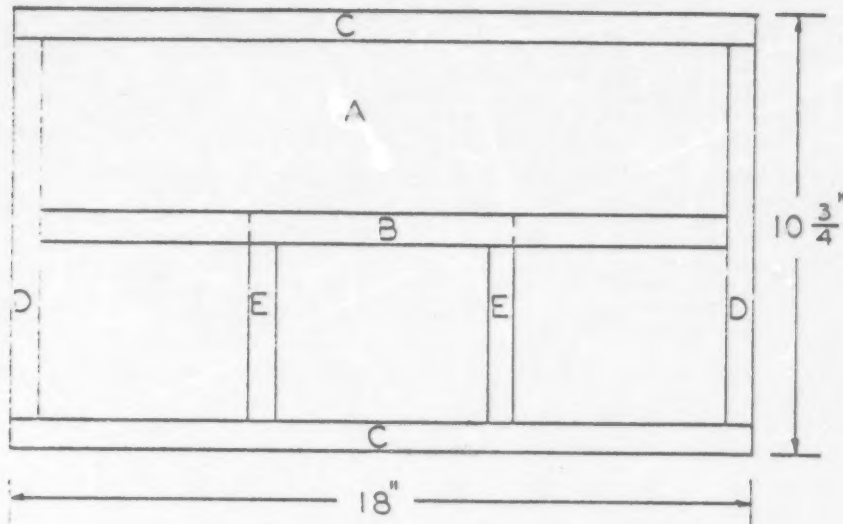




MATERIAL: $\frac{3}{4}$ " PLYWOOD, NAILED AND
GLUED TOGETHER.



SMALL ENGINE WORK STAND

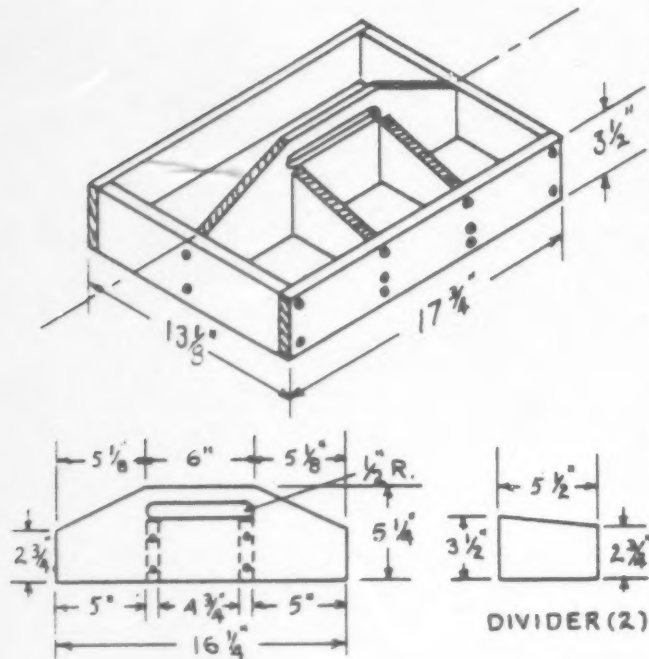


6 1/2" X 9 1/4" A	16 1/2" X 5 1/4" B	9 1/4" X 3 3/4" D	9 1/4" X 3 3/4" D	3 X 4 1/4" E
	18" X 3 3/4" C	18" X 3 3/4" C		3 X 4 1/4" E

1" X 10" X 5'-0"

NAIL BOX

Order No. 553

Materials:

- | | | |
|----|-------------------------------------|------------|
| 1. | 1 - 3/4" x 11-5/8" x 16-1/4" | - Bottom |
| 2. | 2 - 3/4" x 3-1/2" x 11-5/8" | - Ends |
| 3. | 2 - 3/4" x 3-1/2" x 17-3/4" | - Sides |
| 4. | 1 - 3/4" x 5-1/2" x 16-1/4" | - Handle |
| 5. | 2 - 3/4" x 3-1/2" x 5-1/2" | - Dividers |
| 6. | 26 - 8# x 1-1/2" F.H. Wood Screws | |
| 7. | 7d Nails. | |
| 8. | Waterproof or water resistant glue. | |

NAME: _____

DATE: _____ EVALUATION: _____

Construction Teaches: Ability to . . .

1. Read a plan.
2. Lay out the parts on a board.
3. Select the correct saws.
4. Saw materials to dimension.
5. Select the correct plane.
6. Use the plane.
7. Use a drill to drill pilot, body and countersink holes for screws.
8. Select different types of screws and nails.
9. Drive screws.
10. Select the correct sandpaper.
11. Paint the complete project.
12. Properly clean paint brush and can.

Construction Procedure:

1. Select materials: boards, nails, screws, sandpaper and paint.
2. Lay out the parts.
3. Saw to dimension.
4. Plane to dimension.
5. Sand surfaces.
6. Assemble with finishing nails.
7. Prebore holes for screws.
8. Disassemble and mix glue.
9. Apply glue, assemble with nails and screws.
10. Clean excess glue from joints.
11. Sand and finish joints.
12. Paint.
13. Clean the paint brush and can.

Evaluation Score Sheet:

Item	Points	
	Possible	Earned
1. Correct dimensions		
length	5	_____
width	5	_____
height	5	_____
handle	25	_____
dividers	10	_____
2. Square corners & joints.	10	_____
3. Placement of screws. . .	15	_____
4. Paint finish	10	_____
5. Overall appearance . . .	5	_____
6. Attitude and work habits	10	_____
	100	_____

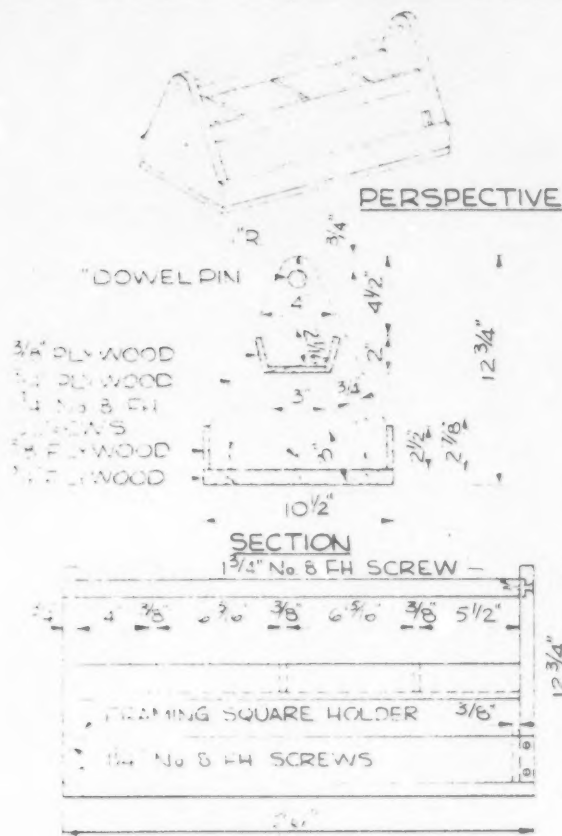
HOBAR PUBLICATIONS

1005 Teller Lane

St. Paul, Minnesota 55112

Order No. 554

NAIL & TOOL CARRIER

Materials:

1. 2 - 3/4" x 9-3/4" ends
2. 1 - 3/4" x 10-1/2" x 26" bottom
3. 2 - 3/8" x 2-1/2" x 26" sides
4. 1 - 3/8" x 3" x 24-1/2" tray bottom
5. 2 - 3/8" x 2-1/16" x 24-1/2" tray sides
6. 1 - 3/8" x 2" x 11" tray partition
7. 1 - 1" x 26" dowel pin
8. 2 - 3/8" x 3/4" x 3" framing square holder
9. 8 - 1-1/2" #8 F.H. wood screws (sides)
10. 6 - 1-3/4" #8 F.F. wood screws (ends)
11. Nails, 3d & 7d
12. Exterior plywood or pine boards as desired
13. Waterproof or water resistant glue

NAME: _____

DATE: _____ EVALUATION: _____

Construction Procedure:

1. Lay out material from cutting list.
2. Cut parts to dimension.
3. Bevel edges of bottom of tray.
4. Bore holes for handle in ends.
5. Assemble with small nails to check dimensions.
6. Prebore screw holes.
7. Disassemble and mix glue.
8. Apply glue, assemble with nails and screws.
9. Clean excess glue from joints.
10. Allow glue to set.
11. Sand and finish joints.
12. Paint or varnish.

Construction Teaches: Ability to . . .

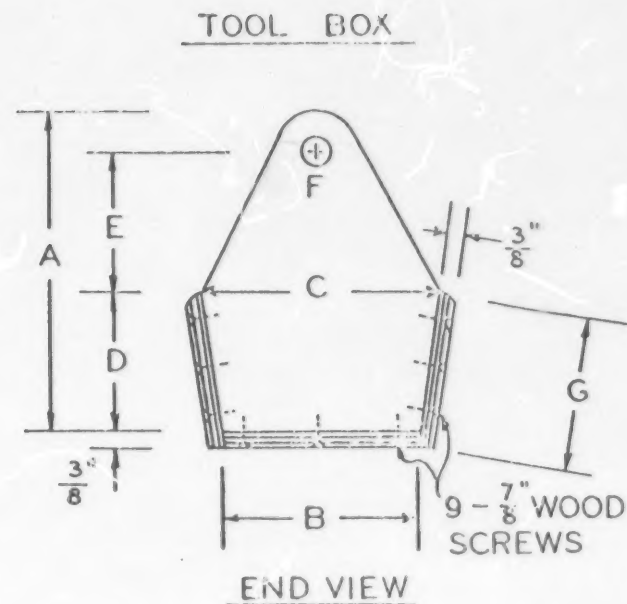
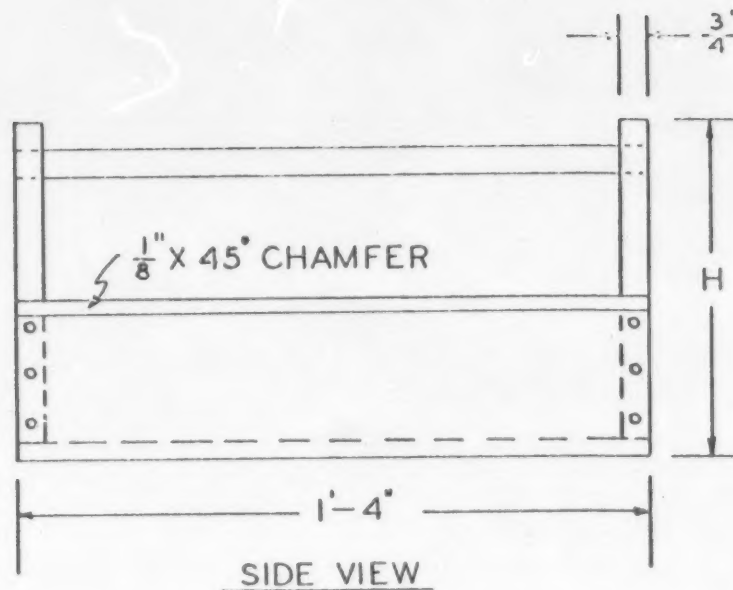
1. Read a plan and prepare a cutting list.
2. Measure and mark dimensions.
3. Select correct saw and saw blade.
4. Saw boards to dimension.
5. Use a saber, jig or band saw.
6. Use brace and bit or electric drill and bit.
7. Select correct nails and screws.
8. Select correct wood adhesive.
9. Glue, nail & drive screws during assembly.
10. Sand and finish wood for painting.
11. Select paint or varnish
12. Apply paint or varnish, clean & store brushes.

<u>Evaluation Score Sheet:</u>		<u>Points</u>	
<u>Item</u>	<u>Possible</u>	<u>Earned</u>	
1. Correct dimensions:			
length	10	_____	
width	10	_____	
height	10	_____	
handle placement	5	_____	
tray location	10	_____	
2. Square corners & joints	10	_____	
3. Edges square and smooth	10	_____	
4. Placement of nails and screws	5	_____	
5. Finish and painting	10	_____	
6. Overall appearance	10	_____	
7. Safety & work habits	10	_____	
Total Points	100	_____	

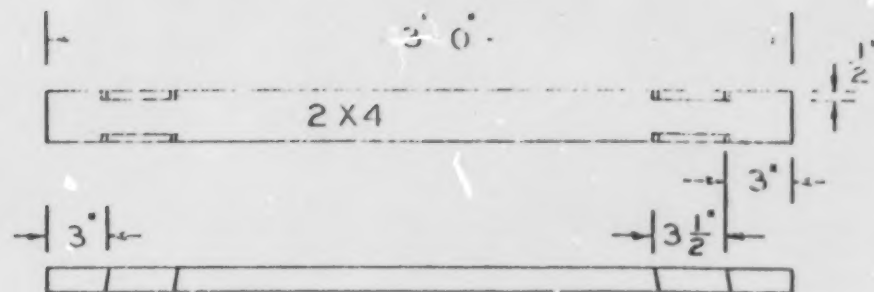
HOBAR PUBLICATIONS

1305 Tiller Lane

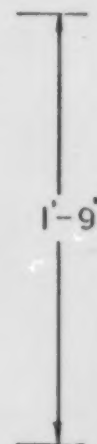
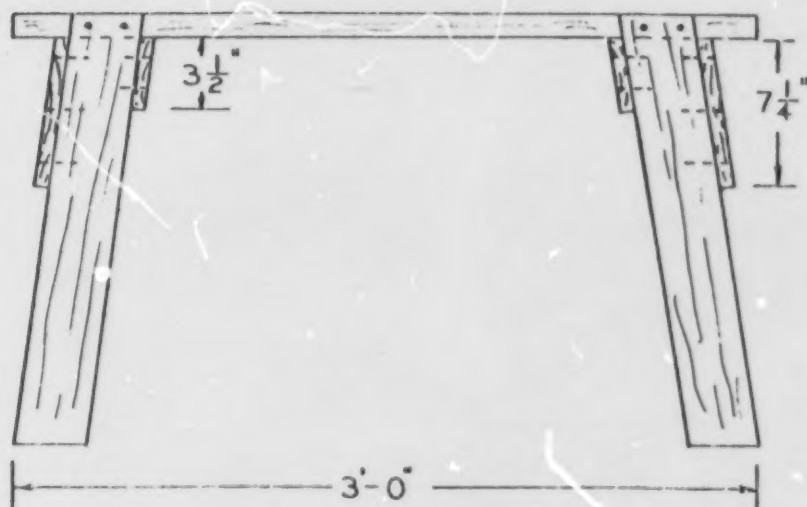
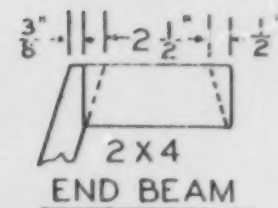
St. Paul, Minnesota 55112



	LARGE	MEDIUM	SMALL
A	12"	9 $\frac{1}{2}"$	8"
B	7 $\frac{1}{2}"$	6"	5"
C	9"	7"	6"
D	5"	4"	3 $\frac{1}{2}"$
E	5 $\frac{3}{4}"$	4 $\frac{1}{2}"$	3 $\frac{1}{2}"$
F	1 $\frac{1}{4}"$ R	1" R	1" R
G	5 $\frac{3}{8}"$	4 $\frac{3}{8}"$	3 $\frac{7}{8}"$
H	12 $\frac{3}{8}"$	9 $\frac{7}{8}"$	8 $\frac{3}{8}"$



SAWHORSE



SIDE VIEW

END VIEW

MATERIALS:

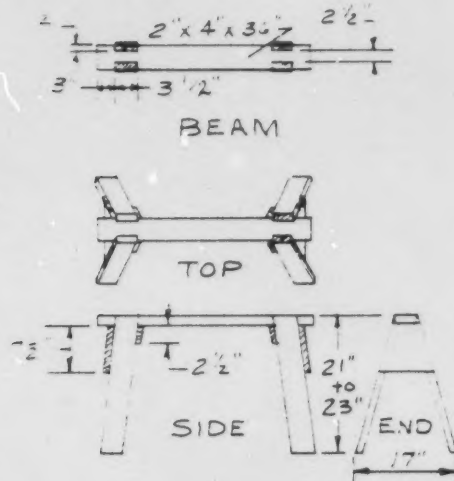
- 1 - 2X4 X 3'-0" CONST. DOUGLAS FIR
- 1 - 1X4 X 9'-0" 2 WHITE PINE
- 1 - 1X8 X 1'-8" 2 WHITE PINE
- 20 - 7d GALV. BOX NAILS
- 8 - 1 1/2" 12 F WOOD SCREWS

956

957

Order No. 555

SAWHORSE



Evaluation Score Sheet:

Item	Points	
	Possible	Earned
1. Dimensions (20)		
Sawhorse height	8	_____
Spread of legs	8	_____
Beam extension	4	_____
2. Angles (28)		
90° beam end to horizon- tal surface	6	_____
Centerline, equal spread of legs	6	_____
Bevel, bottom of legs . . .	8	_____
All legs on floor	8	_____
3. Joint Preparation		
4 leg joints	12	_____
2 outside braces	6	_____
2 inside braces	6	_____
4. Assembly and Finish		
Screws, nails and glue properly used	10	_____
Finish	8	_____
Safety and work habits .	10	_____
Total	100	_____

Construction Procedures:

1. Lay out legs and beam with framing square.
2. Cut leg angles and notch beam.
3. Assemble with scaffold nails.
4. Brace legs to desired measurements using temporary braces.
5. Cut permanent leg braces, tack in place.
6. Pre-bore screw holes in legs and braces.
7. Disassemble, apply glue to legs, joints & braces.
8. Assemble with temporary braces.
9. Check measurements with framing square.
10. Insert screws, remove temporary braces.
11. Wipe off excess glue, allow glue to set.
12. Finish with plane or sandpaper and paint.

Construction Teaches:

Ability to

1. Understand correct sawhorse height, spread of leg and beam extension.
2. Lay out edge and side angles of the leg.
3. Determine & lay out total length of leg.
4. Lay out cuts on beam and braces.
5. Saw boards and chisel leg joints on beams.
6. Select correct wood adhesive.
7. Select correct wood screws and nails.
8. Glue, assemble, screw and adjust to desired measurements.
9. Prepare sawhorse for painting.
10. Select and apply paint.
11. Properly clean brushes and painting utensils.

Materials:

1. 1 - 2" x 4" x 3'0" Const. Douglas Fir
2. 1 - 1" x 4" x 9'0" #2 White Pine
3. 1 - 1" x 8" x 2'6" #2 White Pine
4. 24 - 1-1/2" 39 Bright F.H. Screws
5. 1 - Pint of paint, desired color
6. 4 oz. of Resorcinol Resin or Casein Glue
7. Sawhorse Layout with the Framing Square, Manual - HoBar #165

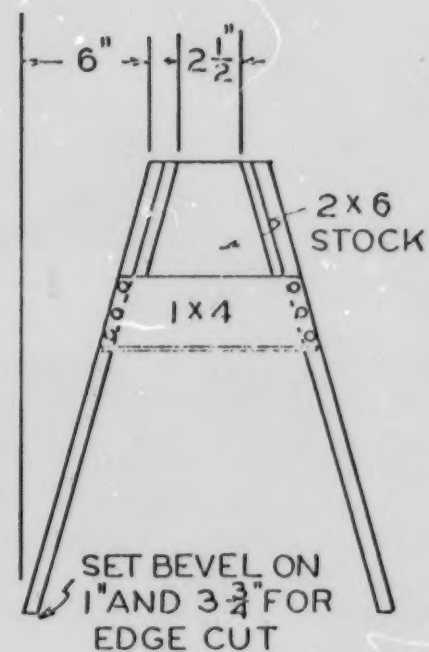
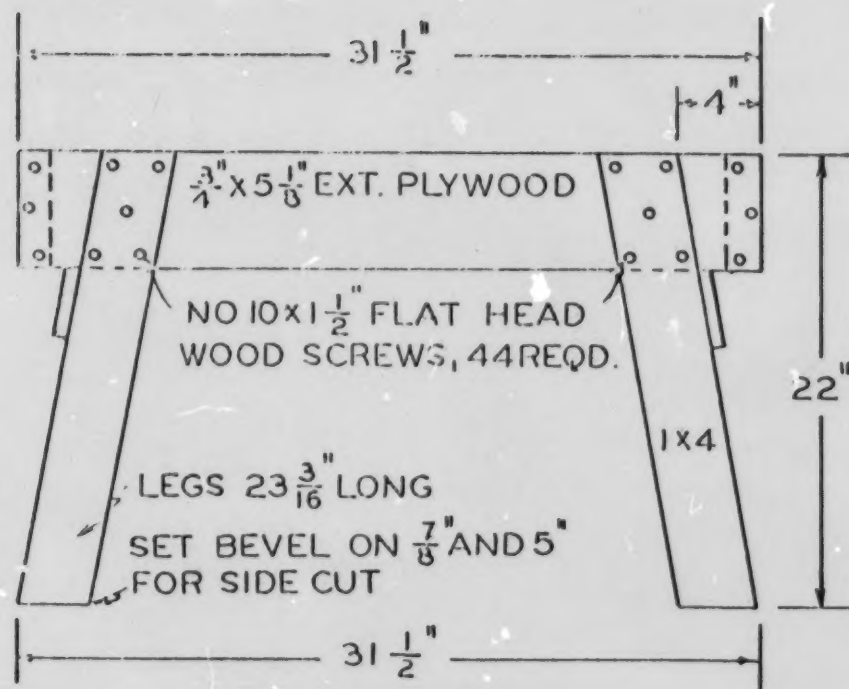
NAME: _____

DATE: _____ EVALUATION: _____

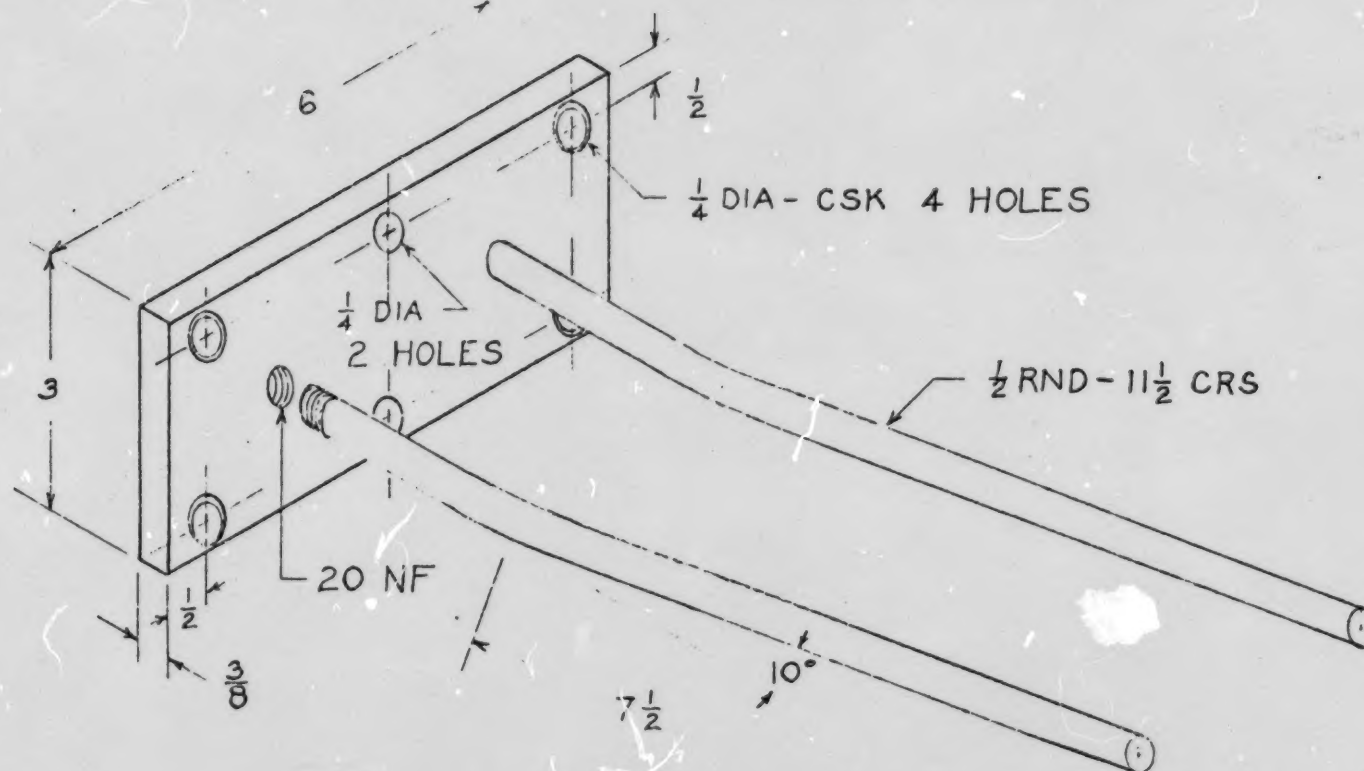
HOBAR PUBLICATIONS

1905 Filler Lane

St. Paul, Minnesota 55112



OPEN TOP SAWHORSE



AGI-XVI-259

DR. BY:

TITLE: BROOM RACK

SCALE: 6"=1'0"

DATE: 2/22/78

PROB.

PERIOD

DR. NO.

Local Adaption --- Plant Science
Home Vegetable Production

There are three Plant Science units provided in this guide:

1. Home Vegetable Production
2. Horticulture (Annual Flowers and Terrariums)
3. Alfalfa Production and Hay Quality Testing

These units are provided to allow the instructor maximum flexibility in meeting local community and student needs. It is suggested that the instructor identify which unit best fits the community and/or student interests and present only that unit.

Four weeks are allotted for plant science information in the freshman year program, as outlined in this guide. If the local instructor and advisory committee deem it appropriate, more than one of the plant science units could be used if the instructor were to remove the areas of duplication within the units. If more than one unit were presented during the freshman, or beginning agriculture class, an appropriate amount of time must be deleted from other units provided in the Agriculture I curriculum.

PLANT SCIENCE

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Identify the major vegetable crops grown in Oregon.
2. Know the monetary contribution of vegetable production to Oregon's economy.
3. Explain which vegetable crops are of highest economic value to their county.
4. Understand how seeds germinate and apply that information to crop production practices in the county.
5. Understand how light affects plant growth and apply that information to crop production practices in the county.
6. Understand how moisture affects germination and plant growth, apply that information to crop production practices in the county.
7. Understand how temperature affects plant growth and why certain crops are grown in the county.
8. Understand how plant competition affects plant growth and apply that information to crop production practices in the county.
9. Plant seed correctly.
10. Transplant seedlings correctly.
11. Lay out a garden plot plan which promotes optimum production in accordance with information learned in this unit.

12. Develop a garden management plan which promotes optimum production in accordance with the information learned in this unit.

References

1. Growing Vegetables in the Home Garden, Extension Bulletin No. 202; Bulletin Clerk, Oregon State University, Corvallis, Oregon 97331
2. Student Manual, Texas A & M University, F.E. Box 182, College Station, Texas 77843
3. Exercises in Biological Principles for Agricultural Crops, Vocational Education Productions, California State Polytechnic University, San Luis Obispo, California 93407
4. Plant Science, Instructional Materials Lab., University of Missouri, Columbia, Missouri 65201
5. Plant Growth and Development, Ohio Agricultural Education Curriculum Materials, Ohio State University, Room 254, Fyffe Road, Columbus, Ohio 43210

Instructor Activities:

1. A teaching outline is part of this unit--it is left to your discretion as to whether you duplicate all or part of that material for student use. (Secure copies of reference # to complete the teaching outline)
2. It is the instructor's responsibility to identify jobs throughout the unit which tie with the instruction being given at any particular point in the unit.
3. Exercises are provided to enhance student understanding of concepts.
4. Statistical information about the economic value of Oregon's crops is up-dated annually. The instructor should update the information provided herein each year. To secure crop and livestock information for the year write to:

Stanely D. Miles, Extension Economist
Economic Information
219 Extension Hall
Oregon State University
Corvallis, Oregon 97331

Ask for:

1. Oregon 19__Gross Farm Sales Preliminary Estimates
2. Oregon's Leading Agricultural Commodities, Gross Farm Sales

These two references are provided in the instructional unit to familiarize you with them. Order current year's information from Stan Miles in December.

5. For very specific information on crops important to the local area contact the local county extension office and ask for Commodity Data Sheets and Enterprise Data Sheets for the particular crops that are of greatest importance to the county.
6. Secure materials and prepare equipment for exercise used. The instructor should start exercise planting from seed in April. Leave them in an obvious place to start generating interest for the "next" unit. Use plants in the exercises that are of economic importance (as identified in #4 and #5 above) whenever possible.
7. Assign students to develop a garden plot plan and management plan.

Student Activities:

1. Participate in discussions and demonstrations.
2. Complete exercises assigned.
3. Apply scientific information (plant growth requirements) to crop production practices.
4. Start vegetable garden seeds in school greenhouse or in greenhouse flats covered with clear plastic, newspaper, or glass, and leave them in a window in the classroom and/or shop. (Note: See reference #1 - Growing Vegetables in the Home Garden for flat preparation, transplanting, and planting system information.)
5. Seed should be sown early in the unit so thinning and/or transplanting to individual pots can be done toward the end of the unit.
6. Develop a garden plot plan which utilizes plant growth requirement information learned in this unit (i.e., row orientation, spacing, plant spacing, size and shape of garden area).
7. Develop a garden management plan which utilizes plant growth requirement information learned in this unit (i.e., watering, fertilizing, weeding, lighting, and harvesting plan).

OREGON LEADING COMMODITY SHEETS

Teaching Outline: Home Vegetable Production

1. Importance of Plants

- a. Plants furnish most of the necessities of life for people, either directly or indirectly. If plant life suddenly disappeared from this plant-oriented globe, humans and animals would also disappear. Plants furnish the following necessities on this earth:

- Oxygen for people and animals to breathe
- Fuel for heating and transportation
- Building materials
- Medicines and drugs
- Foods for people and animals' nutrition
- Fabrics for clothing and other purposes
- Plastics
- Paper
- Cover against water and wind
- Erosion
- Cover for recreation and sports facilities
- Habitat for plants and animals
- Landscape beautification

- b. The two most important achievements of people since prehistoric times have been the domestication and selection of plant species.

2. History of Crop Production

- a. Crop culture began about 10,000 years ago when people planted their first seed in the soil and domesticated their first animal. Before people domesticated plants and animals they had little control over a continuous and adequate supply of food and clothing. People existed as nomadic hunters who gathered food and fiber by searching for it as they wandered over the earth.
- b. About 10,000 years ago hand-labor cultivation began in the middle East. The early agriculturist had to draw upon wild plants and animals in order to develop the major food plants and major animal breeds that are prevalent today. Agriculture spread from the middle East to the western and northern shores of the Black Sea and then to the Valley of the Indies in eastern India and to northern China. The growth and development of early agriculture in the Western Hemisphere has been considered independent of agriculture and development in the eastern part of the world.

c. First crops of importance:

Two varieties of wheat and barley were discovered in Iraq that indicated it had been grown seven thousand years ago. Both wheat and barley were developed in southwestern Asia. Wheat was first grown in Massachusetts in 1602.

Fossilized corn pollen said to be 60,000 years old has been discovered below Mexico City. Small corn cobs thought to be 6,000 years old were found in a cave in New Mexico. Corn and potatoes were among the major cultivated plants discovered in the New World.

Rice was used extensively as a cereal in China by 2800 B.C. There are several wild species of it in southeast Asia; it is thought to have been developed in Asia. Rice was successfully grown in the New World for the first time in 1685, in the Carolinas.

Cotton, the king of fibers, was developed before the first century. In 1929, cotton fibers that dated back to 3000 B.C. were found in Pakistan. Cotton was grown in India about 5,000 years ago. When Columbus discovered the New World (1492) he found both cotton and tobacco being used by the natives.

Sorghums originated as a civilized plant in Africa thousands of years ago. Grain sorghum was developed in Africa, China, and India as a human food. It was developed in the United States mainly as a feed for livestock and poultry.

Crop production was considered a highly developed art at the time it appeared in Egyptian, Greek, and Roman writings.

d. The people from the Old World (Europe) brought many of their agricultural practices and skills to the New World (North America). Even though many of the crops were different from those found in Europe, similar farming practices were used to grow corn, tobacco, rice, and cotton.

Approximately 90 percent of the colonists were engaged in farming as late as 1800. Tobacco, rice and cotton were the major export crops produced by the colonies. The invention of the cotton gin in 1793 and the invention of the mechanical reaper in 1831 increased the possibilities of exporting cotton and producing more grain crops in the United States.

3. Crop Land Area and Use

- a. Only 7.7 percent of the earth's surface is adaptable to cultivation, and 70 percent of this area (1.6 billion acres) is in grain crops.

All the food and fiber crops in the United States (50 states) is produced on about 1,837,000,000 acres of land. The total land area in the fifty states is 2,271,000,000 acres.

- b. United States land usage for agriculture is as follows: (TM-1)

Crop land	- 458,000,000 acres cultivated
Pasture	- 633,000,000 acres
Forest	- 746,000,000 acres

Agricultural land lost each year to recreation and other usage:

Urban development	- 420,000 acres
Lakes	- 420,000 acres
Airports and roads-	160,000 acres

- c. Harvested land area and land use in Oregon.

Oregon has a total land area of 62 million acres. Slightly more than 50 percent of the state is publicly owned, with most of this land managed by the U.S. Forest Service and the Bureau of Land Management.

Within the state, there are 19.5 million acres of land in farms. Each year, Oregon farmers harvest crops from approximately 4 million acres. The significant difference between total farm land and harvested acreage is attributed to large areas of range and pasture, located primarily in the eastern part of the state.

4. Importance of United States Agriculture

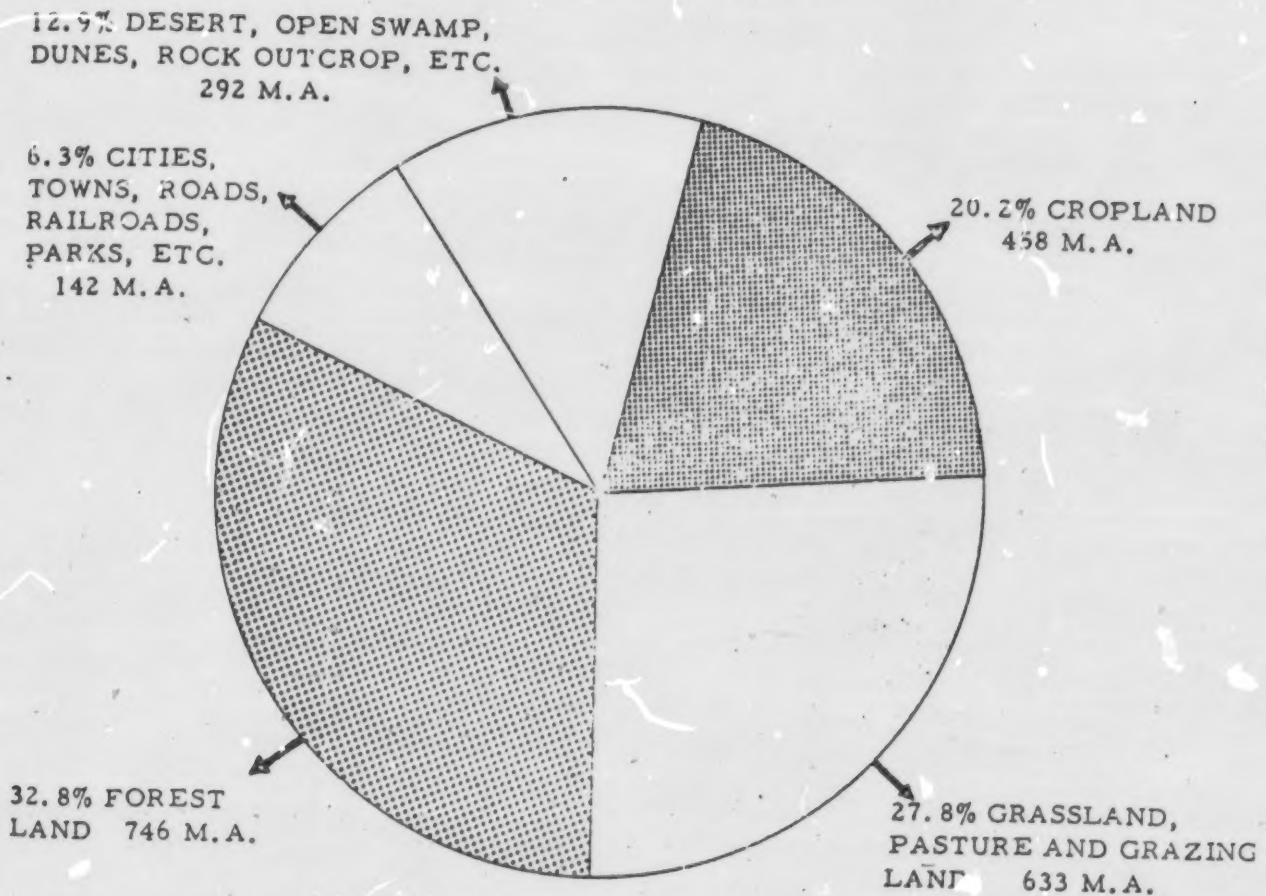
- a. No country in the world can compete with the United States in the quantity and quality of foods produced from plants. At the turn of the century one farmer was producing enough food for himself and five other people. Millions of tons of grain and fiber are exported each year from the U.S. to countries that are unable to produce enough agricultural products to meet the needs of their people.

- b. The reasons that the U.S. is producing an abundance of crop products are:

- (1) education in agriculture
- (2) adequate capital
- (3) continuous research
- (4) abundance of arable soil
- (5) proper use of technology
- (6) adequate labor force

MAJOR USES OF LAND

TOTAL U.S. ACREAGE
2,271 MILLION ACRES (50 STATES)



M.A. - MILLION ACRES

5. The Major Factors That Restrict Crop Areas

The four major factors that restrict crop areas are: climate, soil, economic factors, and available water supply.

- a. Climatic conditions consist of rainfall, length of growing season, temperature, wind velocity, humidity, sunlight, and day length.

Crops differ in their capacity to grow and produce under various climatic conditions.

Cotton, rice, sorghum, corn, and certain vegetables do better in warm climates.

Wheat, potatoes, sugar beets, and many cereals (except corn) do better in cool climates.

Flax, spring oats, wheat, and barley are adaptable to semi-arid regions of the world. They are found in moderately dry areas in North America, Europe and Asia.

- b. Soils differ in type, thickness of various layers, texture, color, and compactness. Much of the land is not suited for crops due to the following reasons:

- (1) Low fertility
- (2) Poor drainage
- (3) Rocky and rough surface
- (4) Improper soil type
- (5) Too hilly for cultivation

- c. Economic factors that affect the type of crop grown in any country are:

- (1) Land value
- (2) Labor requirements
- (3) Transportation
- (4) Demand for certain type of crops
- (5) Shortage of either seed, fuel, labor and/or fertilizer

Land with a high value requires a high unit value crop. Hand labor is still needed in certain crop areas. Fruits and vegetables are generally harvested by hand labor. Transportation cost is a factor that may determine a crop enterprise. The method of transportation generally is not a limiting factor in crop production. Certain areas of population demand a specific type of crop. It is necessary that parts of the world grow rice because people demand rice as a basic food.

- d. Available water supply is considered in the form of both underground and surface water. Dams on rivers and smaller streams are generally constructed for three purposes; water to be used for fertile land

irrigation, flood control and electrical production. Underground water is not always available for all fertile land areas. Although approximately 36,978,000 acres are under irrigation in the United States, irrigation practices in underdeveloped countries are inadequate to meet the needs of desirable crop production standards.

6. How Important is the Crop Plant?

- a. Human beings and their domesticated animals have always depended upon the plant as an important source of food. Past and present experience with plants are identified below:

More than 3,000 species of plants have been used since the beginning of domesticating crops for food and fiber.

About 150 species have been cultivated for food and fiber.

- b. Seventy-five percent of the calories in the diets of people in underdeveloped parts of the world come from cereals, potatoes, sweet potatoes, yams, cassava, and other tropical crops. In the developed countries of the world only 35 percent of the calories in a diet are provided by starch foods.

7. Table I contains all of Oregon's agricultural crops which achieved gross farm sales in excess of 1 million dollars.

- a. The gross sales value for all crops can be found on the "Gross Farm Sales" page at the top of the page, under the headings "The State" and "All Crops".
- b. Note to instructor:
1. Use Table 1 to find those crops of most importance to the state.
 2. Use Table 2 to identify those areas of the state which produce large amounts of crops and identify the crops within which various counties tend to specialize. Explain this production trend using climate and soil to explain production trends.
 3. Using Tables 2 and 3 find your county and identify those crops which contribute most to gross sales in your county (i.e., cereal, vegetables, etc.)
 4. Gather information at your local county extension office about those vegetable crops which contribute most to your local economy.

OREGON'S LEADING AGRICULTURAL COMMODITIES

Gross Farm Sales

1980

Rank	Commodity	1980p	1979r	1978
----- thousand dollars -----				
1	Cattle & calves	313,882	340,000	240,000
2	Wheat	309,025	214,025	176,423
3	Dairy products	160,592	133,327	114,622
4	Nursery crops	87,089	n/a	n/a
5	Potatoes	83,218	63,830	69,773
6	Alfalfa hay	74,523	36,700	27,992
7	Farm forest	48,515	50,411	40,525
8	Chicken eggs	30,653	26,003	23,072
9	Broilers	27,339	23,251	19,701
10	Winter pears	26,159	26,880	22,752
11	Perennial ryegrass seed	25,638	21,602	13,490
12	Snap beans, processed	24,838	26,208	21,570
13	Barley	24,250	16,072	14,487
14	Christmas trees	24,212	17,814	14,620
15	Sheep & lambs	23,895	19,480	15,000
16	Peppermint (oil)	23,372	26,163	36,366
17	Apples	22,659	18,345	15,762
18	Onions	20,728	12,393	22,132
19	Sweet corn, processed	17,087	18,217	18,740
20	Annual ryegrass seed	17,001	19,291	20,010
21	Hops	16,383	9,314	8,390
22	Filberts	16,349	12,078	11,029
23	Sweet cherries	15,897	20,672	22,050
24	Strawberries	14,735	14,370	9,183
25	Greenhouse crops	14,644	n/a	n/a
26	Hogs & pigs	14,524	14,404	14,266
27	Bartlett pears	13,042	14,620	10,823
28	Turkeys	11,119	10,307	11,551
29	Kentucky bluegrass seed	10,537	10,214	8,888
30	Green peas	10,342	7,595	6,810
31	Other hay	10,307	6,500	5,300
32	Sugarbeets for sugar	9,176	4,550	5,278
33	Oats	8,575	4,726	4,491
34	Bentgrass seed	7,504	8,550	5,175
35	Horses & mules	7,447	6,918	5,502
36	Orchardgrass seed	6,600	6,120	4,704
37	Mink	5,959	5,502	4,640
38	Chewings fescue seed	5,907	5,184	3,186
39	Dry field beans	5,656	2,280	803
40	Prunes & plums	5,384	4,784	2,890

		AgI-XVII-11		
Rank	Commodity	1980p	1979r	1978
		----- thousand dollars -----		
41	Turf sod	5,215	n/a	n/a
42	Tame blackberries	4,899	8,162	10,211
43	Red fescue seed	4,826	3,848	3,705
44	Corn silage	4,752	3,943	3,350
45	Sugarbeet for seed	4,312	3,010	2,800
46	Red clover seed	4,226	4,064	4,150
47	Alfalfa seed	4,141	5,166	6,521
48	Peaches	3,817	3,072	2,327
49	Vegetable & flower seek	3,678	4,223	4,835
50	Red Raspberries	3,251	6,720	7,162
51	Bulbs	3,195	2,893	2,615
52	Wool	2,988	3,069	2,645
53	Tall fescue seed	2,973	1,872	1,796
54	Cucumbers, processed	2,824	2,374	2,400
55	Dry field peas	2,628	2,613	1,784
56	Cranberries	2,378	2,410	2,051
57	Sweet corn, fresh	2,324	2,138	1,465
58	Cauliflower, processed	2,311	2,381	2,490
59	Corn for grain	2,289	1,815	1,801
60	Cabbage	2,094	1,620	1,462
61	Grapes	2,091	1,734	522
62	Squash & pumpkin	2,029	1,800	1,782
63	Beets, processed	1,927	2,067	1,817
64	Lettuce	1,862	1,667	1,874
65	Pinto beans	1,650	---	32
66	Blueberries	1,551	1,572	1,837
67	Turkey eggs	1,514	1,609	1,672
68	Black raspberries	1,485	2,042	1,425
69	Spearmint	1,470	1,453	2,000
70	Walnuts	1,355	1,444	1,416
71	Crimson clover seed	1,300	2,300	1,544
72	Watermelons	1,280	885	812
73	Broccoli, processed	1,272	1,200	1,008
74	Grass & grain straw	1,264	1,172	525
75	Austrain peas	1,254	1,613	1,527
76	Cauliflower, fresh	1,252	1,254	1,008
77	Honey & beeswax	1,222	1,196	1,041
78	Garlic	1,145	1,069	1,393
79	Tomatoes	1,107	969	775
80	White clover & ladino seed	1,037	772	516
81	Carrots, processed	1,023	1,086	655
82	Rabbits	1,011	716	712
Other commodities		46,123	119,606*	89,931*
TOTAL CROSS FARM SALES		1,742,337	1,494,437	1,253,984

p - Preliminary r - Revised. *Includes nursery crops and turf sod.

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

OREGON
1980 GROSS FARM SALES
Preliminary Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
thousand dollars															
THE STATE...	345,403	91,674	94,845	152,915	107,898	30,018	102,417	210,020	1,135,190	313,882	160,592	69,929	62,744	607,147	1,742,337
District 1...	82,956	11,001	78,934	35,820	30,699	25,953	71,976	166,628	503,067	39,611	74,073	63,213	28,650	205,547	708,614
Benton....	5,351	613	6,124	2,341	868	441	4,810	11,300	31,848	2,255	3,640	207	1,230	7,332	39,180
Clackamas...	5,683	1,225	2,834	1,146	1,969	3,899	8,193	35,356	60,355	6,096	6,798	20,698	7,018	40,610	100,965
Lane.....	4,945	482	4,533	3,652	3,665	713	5,309	11,545	34,844	7,110	6,600	7,792	2,125	23,627	58,471
Linn.....	7,745	1,013	37,001	3,577	809	1,151	4,493	7,778	63,572	6,355	8,250	4,898	6,334	25,837	89,409
Marion....	16,190	1,959	17,321	20,637	4,891	9,197	33,813	42,475	146,483	6,194	21,650	9,593	4,678	42,115	183,593
Multnomah...	611	167	82	493	150	2,425	5,413	19,876	29,237	1,000	1,523	243	524	3,290	32,527
Polk.....	15,673	1,113	4,607	2,773	3,366	596	1,642	5,000	34,730	2,654	5,030	5,152	1,908	14,744	49,474
Washington...	8,641	2,740	3,135	974	7,344	6,696	3,890	21,076	57,490	4,267	11,957	646	1,868	18,738	76,228
Yamhill....	17,742	1,679	3,247	227	7,637	835	4,413	9,278	44,508	3,680	8,625	13,984	2,965	29,254	73,762
District 2...	1,073	588	28	164	57	3,457	192	17,857	23,416	18,415	51,373	301	6,503	76,592	100,008
Clatsop....	---	65	---	---	---	41	10	1,820	1,936	1,282	1,914	---	2,201	5,397	7,333
Columbia...	1,073	188	28	142	34	931	92	3,710	6,198	3,367	2,763	4	530	6,664	12,862
Cros.....	---	146	---	---	18	2,175	10	4,272	6,621	5,074	10,940	287	1,394	17,695	24,316
Curry....	---	40	---	---	5	222	---	2,730	2,997	1,722	842	5	1,034	3,603	6,600
Lincoln....	---	25	---	---	---	50	50	3,675	3,800	1,225	260	5	341	1,831	5,631
Tillamook...	---	124	---	22	---	38	30	1,650	1,864	5,745	34,654	---	1,003	41,402	43,266
District 3...	3,127	2,348	438	1,378	18,795	403	1,443	12,875	40,807	21,552	13,436	3,970	6,890	45,874	86,691
Douglas....	2,210	734	77	66	2,470	374	1,096	8,750	15,767	11,234	1,050	647	4,668	17,639	33,406
Jackson....	861	1,175	361	251	16,070	29	279	1,700	20,726	7,985	5,443	3,072	1,509	18,069	38,735
Josephine...	56	439	---	1,061	255	---	78	2,425	4,314	2,333	6,943	237	713	10,226	14,540
District 4...	191,436	21,330	1,092	47,871	56,439	191	12,343	7,420	338,172	47,841	1,315	1,634	9,284	60,074	393,246
Gilliam....	20,227	199	226	103	---	---	---	10	20,770	4,208	---	---	182	4,390	25,160
Good River...	---	172	---	---	35,219	85	72	840	36,388	563	506	315	237	1,621	38,009
Marion....	40,671	12,894	72	27,270	63	---	---	3,020	83,790	7,433	390	---	1,513	9,336	93,326
Sherman....	29,599	125	---	121	20	---	---	---	29,865	1,923	---	1,314	248	3,485	33,350
Umatilla....	81,113	6,175	794	19,921	12,277	106	12,167	2,700	137,660	24,008	419	5	5,881	30,313	167,673
Walla Walla...	17,170	1,693	---	104	8,950	---	104	600	28,772	6,247	---	---	945	7,182	35,954
Wheeler....	505	125	---	147	---	---	---	250	1,027	3,459	---	---	288	3,747	4,774
District 5...	40,697	13,219	8,210	33,571	1,564	14	15,755	1,885	114,905	82,266	13,525	12	5,146	100,949	215,854
Baker.....	3,416	2,279	37	108	10	---	---	510	6,360	16,852	2,448	3	814	20,157	26,517
Malheur....	18,369	7,551	3,286	31,747	293	14	15,410	150	76,820	48,434	10,153	---	1,936	60,523	137,343
Union.....	12,658	1,364	4,887	985	1,261	---	270	525	21,950	6,190	768	6	1,194	8,158	30,108
Wallowa....	6,264	2,025	---	731	---	---	75	700	9,775	10,750	156	3	1,202	12,111	21,886
District 6...	27,074	43,188	6,143	34,111	294	---	703	3,355	114,823	104,197	6,870	773	6,271	118,111	232,934
Crook.....	1,812	9,413	121	3,287	---	---	15	250	14,901	13,782	702	28	471	14,983	29,834
Deschutes...	752	2,502	94	1,323	---	---	---	630	5,301	4,387	2,213	15	1,419	8,034	13,335
Grant.....	171	1,426	---	232	294	---	---	1,250	3,373	8,971	---	45	319	9,335	12,708
Harney....	1,499	4,992	40	---	---	---	---	10	6,541	19,379	---	---	472	19,851	25,392
Jefferson...	6,772	2,609	5,825	12,114	---	---	693	155	28,248	10,205	---	3	1,143	11,381	39,599
Klamath....	14,587	14,550	40	16,720	---	---	---	900	46,797	30,300	3,880	682	1,960	36,822	83,619
Lake.....	1,411	7,616	20	435	---	---	---	160	9,662	17,173	75	---	487	17,725	27,397

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SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 18, 1980

OREGON
1979 CROSS FARM SALES
Revised Estimates

	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	TOTAL GROSS INCOME
THE STATE....	236,959	48,615	93,081	118,742	105,402	37,919	92,584	172,807	906,109	340,000	133,327	60,754	54,217	588,328	1,494,437
District 1...	76,107	8,268	78,794	27,754	26,286	33,776	70,569	131,227	452,781	43,833	60,017	54,670	23,952	182,472	635,253
Benton....	3,870	386	6,375	2,055	777	396	4,985	8,350	27,194	2,841	3,274	217	1,479	7,811	35,005
Clackamas...	4,454	1,083	2,961	715	1,579	6,316	7,572	27,130	51,810	6,634	6,076	19,316	4,511	36,537	88,347
Lane.....	5,943	432	4,344	3,581	3,079	849	5,558	11,850	35,641	7,922	5,298	7,420	1,254	21,894	57,535
Linn.....	7,423	772	35,498	3,638	839	1,561	5,396	3,350	58,987	7,664	7,247	4,139	5,554	24,604	83,591
Marion.....	15,496	1,486	16,322	14,085	3,509	11,142	32,985	29,585	124,610	6,651	15,538	7,055	4,426	33,670	158,280
Multnomah...	523	97	117	262	118	3,671	4,862	17,280	26,930	1,050	1,324	243	483	3,100	30,030
Polk.....	12,935	784	4,852	2,390	3,232	808	1,734	5,317	32,052	3,044	3,574	4,602	1,823	12,443	44,495
Washington...	11,112	2,158	5,182	930	6,491	7,892	3,172	21,250	58,187	3,911	10,625	898	1,729	17,163	75,350
Yamhill....	14,346	1,070	3,143	98	6,662	1,141	4,305	6,605	37,370	4,116	7,061	11,380	2,693	25,250	62,620
District 2...	455	454	63	211	71	3,493	260	17,459	22,466	22,109	43,202	290	5,391	71,492	93,958
Clatsop....	---	41	---	---	---	112	9	1,930	2,094	1,455	1,400	3	1,386	4,744	6,488
Columbia...	455	155	46	211	51	875	191	4,094	6,078	4,514	2,589	4	495	7,602	13,680
Coos.....	---	130	---	---	15	2,171	10	4,205	6,531	5,914	10,234	283	1,207	17,638	21,169
Curry.....	---	28	---	---	5	201	---	2,830	3,064	1,953	776	---	1,084	3,813	6,877
Lincoln....	---	24	---	---	---	96	30	2,500	2,650	1,497	235	---	225	1,957	4,607
Tillamook...	---	74	17	---	---	38	20	1,900	2,049	6,776	27,968	---	914	35,738	37,787
District 3...	2,461	1,785	371	1,375	18,306	501	1,451	13,675	39,925	22,837	11,171	3,236	6,550	43,794	83,719
Douglas....	1,721	709	58	69	1,404	451	1,092	8,950	14,454	12,225	967	663	4,782	18,637	33,091
Jackson....	697	708	313	412	16,658	50	269	1,737	20,844	8,227	4,808	2,316	1,185	16,536	37,380
Josephine...	43	368	---	894	244	---	90	2,988	4,627	2,385	5,396	257	593	8,621	13,248
District 4...	113,774	10,063	1,197	36,619	59,129	137	8,690	4,166	233,775	52,001	1,274	1,761	7,542	62,578	296,353
Gilliam....	10,692	145	198	189	---	---	---	10	11,234	4,975	---	---	220	5,195	16,429
Hood River...	---	124	---	---	39,918	82	54	520	40,698	629	524	349	128	1,630	42,328
Morrow....	31,373	4,553	150	23,369	57	---	352	636	60,490	8,380	378	---	1,434	10,192	70,682
Sherman....	14,117	96	---	162	34	---	---	---	14,369	2,579	---	1,407	232	4,218	18,587
Umatilla...	46,398	3,687	849	12,622	5,494	55	8,188	2,300	79,593	25,522	372	5	4,355	30,254	109,847
Wasco.....	10,925	1,455	---	201	13,626	---	96	600	26,903	7,136	---	---	904	8,040	34,943
Wheeler....	269	43	---	76	---	---	---	100	488	2,780	---	---	269	3,049	3,537
District 5...	28,458	8,532	7,797	24,372	1,453	12	11,292	2,490	84,406	90,316	11,964	20	4,505	106,805	191,211
Baker.....	2,417	1,170	36	176	10	---	---	850	4,889	18,354	2,063	3	766	21,191	26,040
Malheur....	13,474	4,646	4,182	22,737	292	12	10,983	200	56,476	53,138	9,142	8	1,376	63,664	120,140
Union.....	9,100	995	3,579	710	1,151	---	259	608	16,394	6,766	614	6	1,371	8,757	25,151
Wallowa...	3,487	1,561	---	749	---	---	50	840	6,647	12,058	140	3	992	13,193	19,440
District 6...	15,704	19,513	4,859	28,411	157	---	322	3,790	72,756	108,904	5,699	777	5,807	121,187	193,943
Crook.....	1,146	1,630	28	3,256	---	---	15	200	6,275	11,132	554	19	344	12,089	13,364
Deschutes...	584	2,113	128	966	---	---	---	520	4,311	4,777	1,782	11	1,361	7,931	12,242
Grant.....	137	234	---	---	157	---	---	1,580	2,108	9,494	---	44	213	9,751	11,859
Harney....	684	2,730	4	23	---	---	---	10	3,451	19,747	---	---	788	20,535	23,986
Jefferson...	4,215	1,638	4,645	12,043	---	---	307	120	22,968	9,863	---	3	1,034	10,900	33,868
Klamath....	7,448	7,973	44	11,725	---	---	---	1,200	28,390	33,442	3,290	700	1,638	39,070	67,460
Lake.....	1,490	3,195	10	398	---	---	---	160	5,253	20,449	73	---	389	20,911	26,164

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 19, 1980

8. How do Seeds Germinate?

a. What is a seed?

- 1) Seed: a young or embryonic plant in a dormant or resting stage with a supply of food and one or more seed coats. Basic parts include.
 - a) Embryo or germ
 - b) Food supply
 - c) Ovary wall or seed coat (protection)

b. What is germination?

- 1) Germination - the change in the embryo from a dormant condition to one of activity and growth.

c. What are the requirements for the germination of a viable seed?

- 1) favorable temperature - varies from crop to crop
- 2) sufficient moisture
- 3) air containing oxygen

d. Describe the parts and functions of a corn grain (TM-2)

- 1) fused ovary wall (pericarp) - protection
- 2) endosperm - a source of starch as energy
- 3) embryo
 - a) cotyledon - secretes enzymes which break down endosperm
 - b) coleoptile - protection of terminal bud and penetrates soil surface
 - c) epicotyl - above becomes the stem
 - d) axis - dividing point or center of embryo
 - e) hypocotyl - below it becomes the roots
 - f) radicle - develops into the primary root
 - g) coleorhiza - protects radicle - seals it off
 - h) pedicel - tip of kernel

Note: (Have student split a pre-soaked corn seed with a razor and identify the parts)

e. Describe the parts and functions of a bean seed (TM-3)

- 1) Seed coat - protection
- 2) Cotyledon - storage of food
- 3) Epicotyl - stem parts
- 4) Hypocotyl - between stem and radicle
- 5) Radicle - becomes primary root

f. Explain the process of emergence for both bean and corn seeds. (TM-4 and TM-5)

1) Bean

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- a) seed swells as moisture is absorbed - seed coat is ruptured
- b) root goes down
- c) hypocotyl elongates, forms arch and pulls cotyledons upward

- d) when hypocotyl reaches light, elongation ceases and hypocotyl straightens up, pulling cotyledons out of soil
- e) cotyledons turn green and manufacture food until new leaves develop
- f) cotyledons die, dry up and fall off

2) Corn

- a) seed swells as moisture is absorbed
- b) primary (temporary) root goes down
- c) first internode and plumule go up
- d) after plumule emerges, new leaves form and food production starts
- e) new root system forms from top of first internode just beneath soil
- f) temporary root system ceases to function and dies

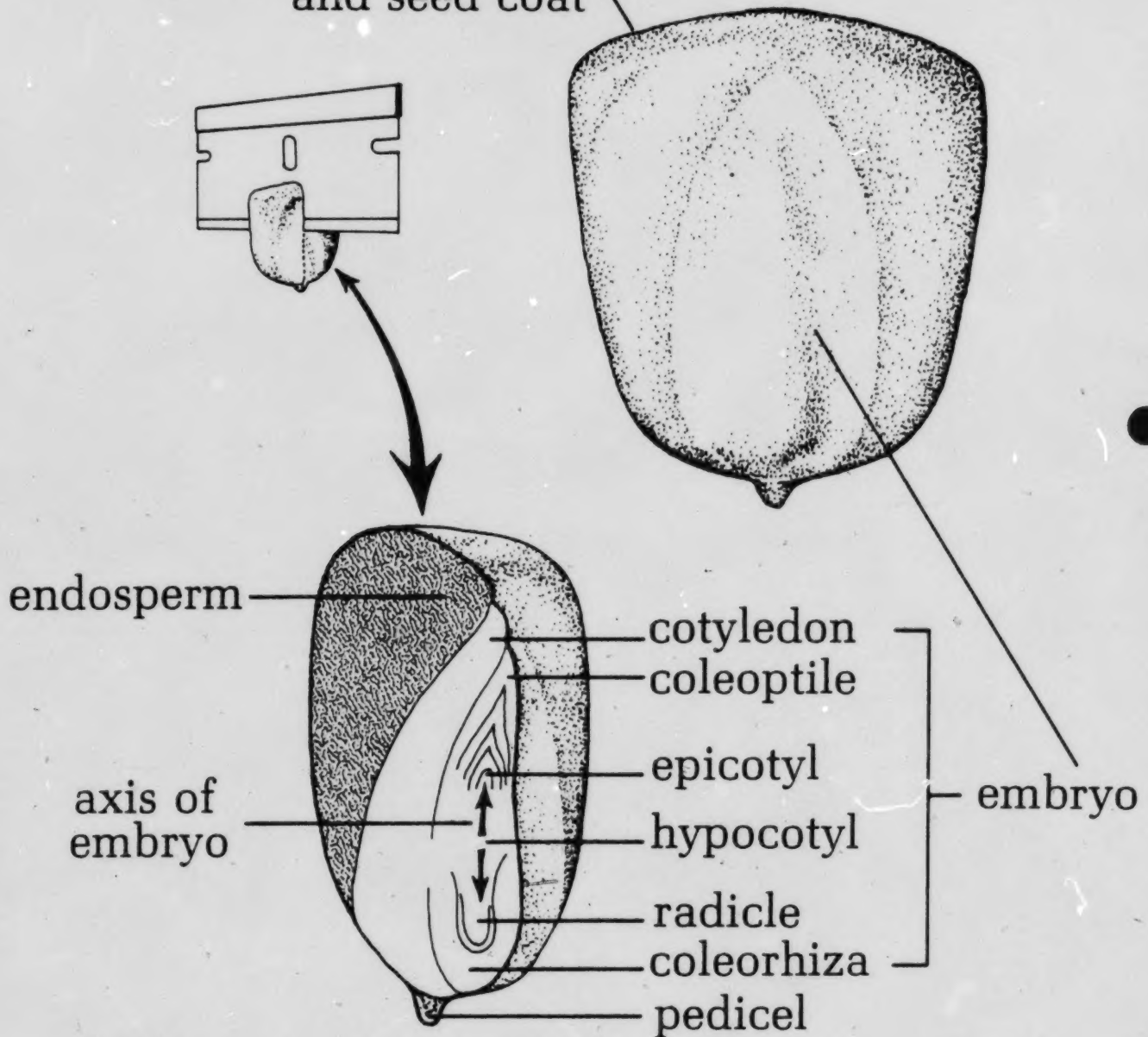
g. Have students relate type of emergence with time and procedures used for planting. Put their ideas on the board. Consider planting beans in pots to demonstrate some variances in the above procedures.

1. Why does type of emergence affect how and when we plant?

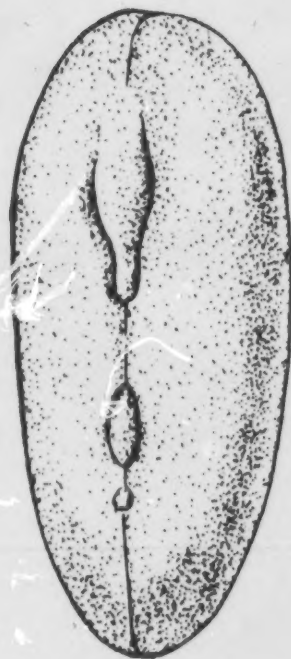
- a) Food supply in emergence
 - 1) corn below ground
 - 2) bean above ground
- b) Corn more tolerant of late freeze

A CORN GRAIN AND ITS PARTS

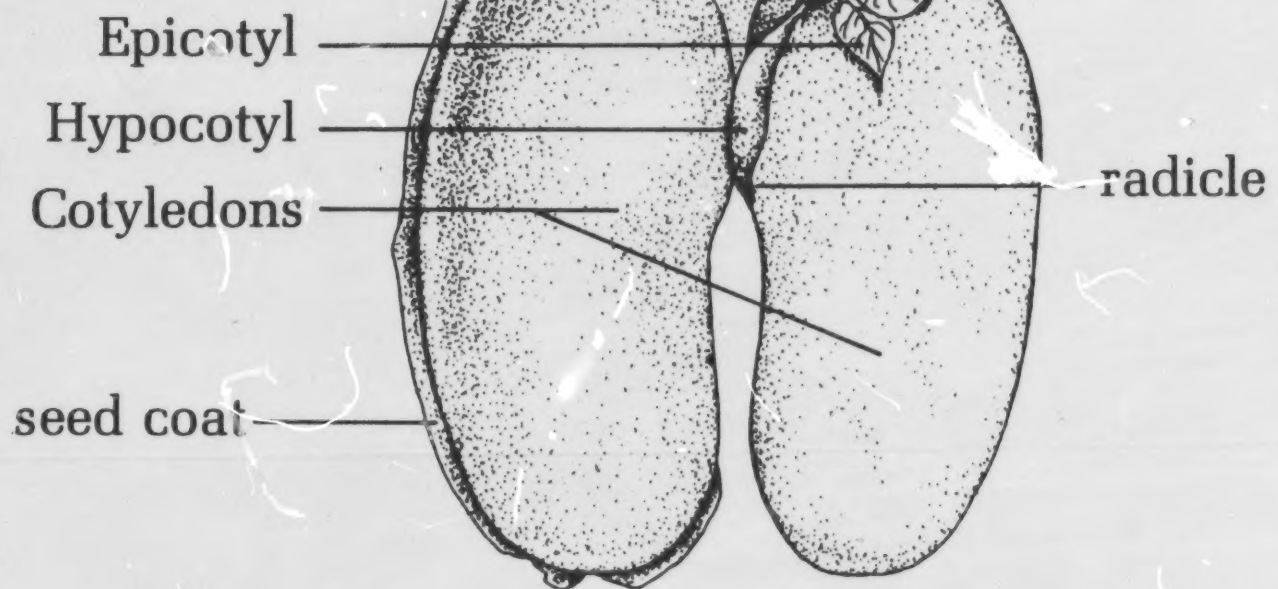
fused ovary wall (pericarp)
and seed coat



A BEAN SEED AND ITS PARTS



Embryo:



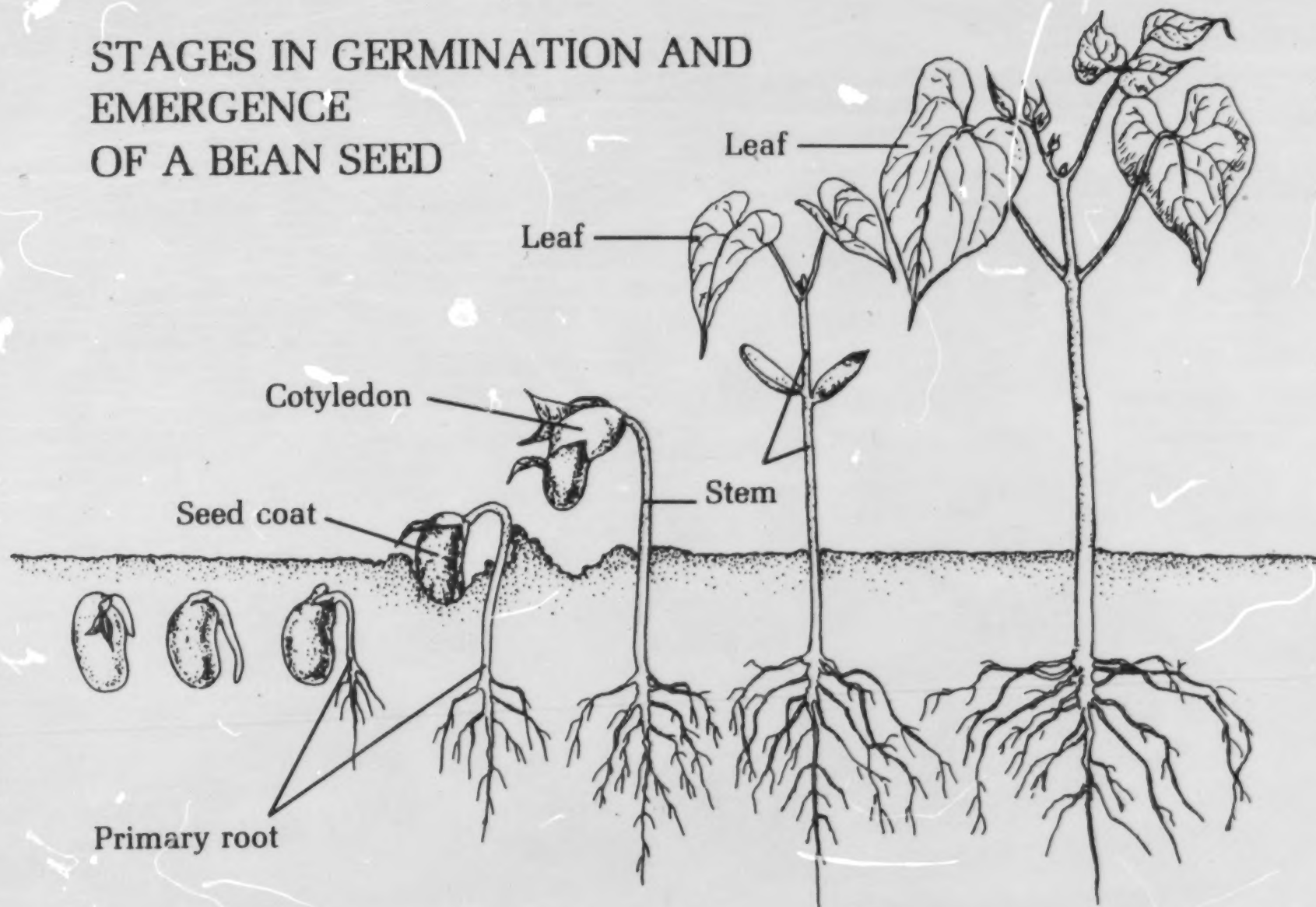
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STAGES IN GERMINATION AND EMERGENCE OF A BEAN SEED



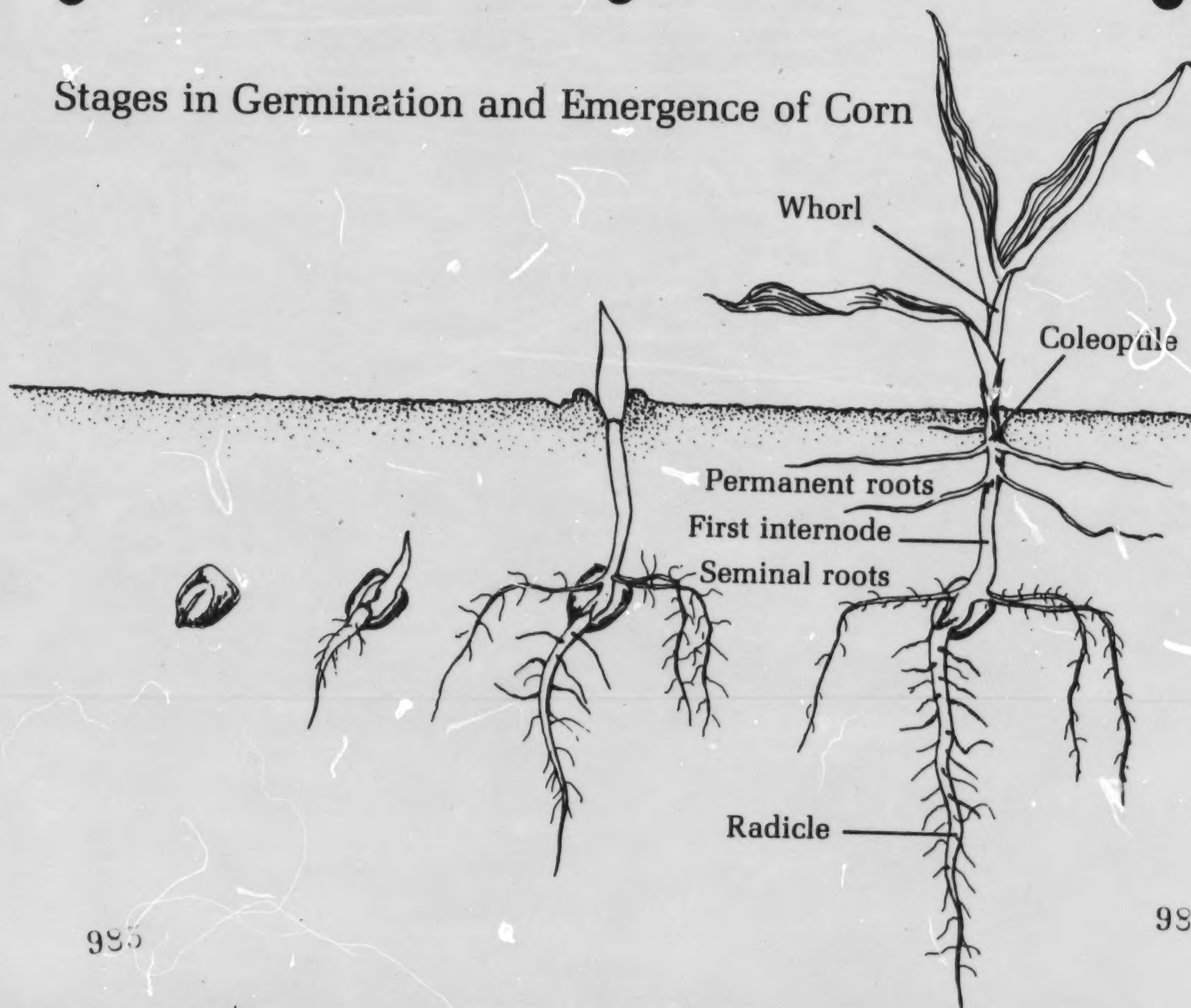
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Stages in Germination and Emergence of Corn



Student Information SheetGERMINATIONSeed Structure and Germination

Each seed contains an embryo, which in actuality is a young plant. It consists of two basic sections, the cotyledon and the embryo axis of the plant (stem and root). The grasses, including corn and wheat, have only one cotyledon so this group is called monocotyledons or monocots. Plants such as beans and cotton are dicots. The cotyledons are actually leaves so they may be called seed leaves. These leaves are connected to the embryo axis the first node. The embryo thus is a small plant since it contains roots, stems, and one or more leaves. The cotyledon (seed leaf) in monocots is specialized in location and function and is called the scutellum.

Seeds have an outer covering (pericarp) in monocots and testa in dicots that serves as protection against disease and mechanical damage. A third part of a seed is the food storage tissue. In monocots the storage tissue is the endosperm and this is located outside the embryo. In dicots, the storage tissue may be either an outside endosperm or the cotyledons (castor beans vs. soybeans). Recall that the cotyledons are actually part of the embryo, so in the case of soybean and pea, the food is stored within the embryo.

Bean Seed

The bean is a true seed so the outer coat is called the testa. The bean is one of the dicots with no endosperm, but the embryo contains two cotyledons for food storage. The stem portion is called the epicotyl, the root portion is called the radicle, (embryonic root that develops into primary root) and the section just below the cotyledon is called the hypocotyl.

Corn Seed

The corn kernel is a caryopsis which is a simple, one-seeded indehiscent (nonsplitting) fruit with a pericarp firmly united around the seed coat in contrast to a soybean "seed" that had the pericarp (pod) fall off in harvest and not attached. The pericarp serves as a protective tissue for the internal parts of the caryopsis and is composed primarily of ovary tissue. This ovary tissue will have the same characteristics as the mother plant. Corn is a monocot, and as such, the embryo contains one cotyledon, known as the scutellum, a coleoptile, short stem with small leaves, a radicle, and a coleorhiza. The primary function of the scutellum is the secretion of enzymes which help break down the carbohydrates in the endosperm to provide energy for use by the germinating seed, and eventually for the seedling. The coleoptile is the uppermost part of the embryo axis and functions as a protective sheath for the terminal bud and young leaves. The coleoptile consists of hard tissue and is pointed. Thus, it is an adapted structure for penetrating through the soil surface.

On the opposite end of the embryo axis is the radicle which is the first part of the embryo to emerge from the kernel during germination and which develops into the primary root. The coleorhiza is a protective sheath which surrounds the radicle. During germination the coleorhiza expands in size as water is imbibed. This gives the appearance of the coleorhiza emerging as the pericarp is broken. The radicle emerges through the coleorhiza during germination, and the coleorhiza provides a seal on the primary root so disease organisms cannot enter through areas where the root broke out of the caryopsis.

Corn has two types of endosperm, the hard or flinty and the soft or starchy endosperm. Both types of endosperm are carbohydrate material adjacent to the aleurone. The aleurone is a layer of cells inside the pericarp and its genetic nature is determined by the male and female plants used in a corn cross. So it is truly not maternal tissue as is the pericarp. The endosperm serves as a source of energy for germination and early seedling growth.

Quiz: Germination and Early Growth

1. Describe the process of germination and early growth of a bean seed.
2. What is the function of endosperm in the corn kernel?
3. What is the purpose of the seed coat?
4. What conditions are necessary for favorable germination?
5. What is an embryo?
6. How do the cotyledons of a bean seed function after emergence and prior to leaf development?
7. Why can we plant corn earlier than beans?

Quiz Answers: Germination and Early Growth

1. a) seed swells as moisture is absorbed--seed coat is ruptured
 b) root goes down
 c) hypocotyl elongates, forms arch and pulls cotyledons upward
 d) when hypocotyl reaches light, elongation ceases and hypocotyl straightens up, pulling cotyledons out of soil
 e) cotyledons turn green and manufacture food until new leaves develop
 f) cotyledons die, dry up and fall off
2. A source of starch for energy.
3. Protection
4. a) favorable temperature-varies from crop to crop
 b) sufficient moisture
 c) air containing oxygen
5. The young plant which is formed within the ovule or seed soon after the egg is fertilized by the male gamete from the pollen tube. It then rests until germination takes place.
6. They turn green and manufacture food until new leaves develop.
7. Corn emerges with food supply below ground while bean emerges with food supply above the ground. Therefore, corn will withstand a late freeze better than beans.

Experiments in Plant Science

Following are experiments which students can do to facilitate learning the effect and importance of light, moisture, temperature on seed germination and plant growth. These activities are left to the instructor's discretion. If you do use these exercises, start them early in the unit.

Plant Ecology

Plant ecology is the study of the mutual relationship between plants and the physical and biotic factors in their environment. Plants are subject to many decisive factors which control their health, growth, fruitfulness, even life itself.

What are these physical and biotic factors upon which plant life is so dependent?

- | | |
|--------------|-----------------------|
| A. Light | E. Temperature |
| B. Soil | F. Pests and Diseases |
| C. Water | G. Competition |
| D. Nutrients | H. Oxygen |

How have people learned to control these factors in crop production?

- A. Both the amount and type of light can be controlled in a number of ways:
 1. The "greenhouse farmer" has close control over the amount of light plants receive by either shading the greenhouse or covering the plants during part of the daylight period or by using incandescent light sources to lengthen the daylight period.
 2. Pruning trees allows more light to reach lower branches or undergrowth.
 3. Occasionally faster growing plants are used to protect very tender plants from excessive sunlight until they are mature enough to withstand full sunlight.
 4. Row spacing is controlled according to the light requirements of the crop grown.
- B. The factors of soil, water, and nutrients are inter-
- C. related. This interrelation can be adjusted in
- D. many ways. For example, the type of soil determines both the water-holding capacity of that soil (which affects the amount of water available to the plant) and the amount of nutrients (such as nitrogen, potassium and phosphorus) available to the plant. Farmers can change the amount of water through irrigation and

its availability by breaking up hardpan and increasing percolation. They can change or modify nutrient level through the addition of fertilizers and growth of nutrient-restoring plants or aerating the soil. Farmers can modify the soil type through the addition of fertilizers and growth of nutrient-restoring plants or aerating the soil. They can modify the soil type through the addition of organic materials such as peat moss and earth worms. Farmers can improve the soil in other characteristics by adding such minerals as gypsum and sand, or such chemicals as sulphurs and sulphuric acid. The soil, water and nutrients form a complex in fact which gives the farmer major control over the plants cultivated.

To contrast the controlling effect upon plants of flooding with water, note that rice fields are covered by up to 6" of water during germination and growth; this prevents the development of many competitive plants. Yet an excess of standing water on alfalfa will drown it.

Another example: The lack of water in desert areas has forced many plants to make adaptations which enable them to survive under very dry conditions, such as seed dormancy that can only be broken by certain levels of rainfall, extended root systems, and much thicker outer leaf coatings of waxes.

- E. Temperature. The "greenhouse farmer" controls temperature through ventilation, the use of mists, the use of fans, and, in some cases, refrigeration.

We know that tomatoes are a warm season crop because no fruit is set under 45°. Stock, on the other hand, only flowers during cool periods. Because of such variations, producers have learned to adjust the planting dates of various crops to fit the temperature requirements of the plant in relation to the climate of the area. Even irrigation can be used as a temperature control factor since spraying cools the air in a growing area.

- F. Pests and diseases. Through scientific research we have learned to control many pests and diseases - by applying chemical insecticides, pesticides, and fungicides; or by developing genetically pest- and disease-resistant strains of the stricken plant. Work with wheat has been the development of a solid stem wheat variety that prevents infestation of wheat stem sawfly. The alfalfa aphid has been controlled by developing a plant resistant to these insects. In addition, certain plants are budded or grafted to other more disease- or insect-resistant varieties to combine the fruitful aspects of one with the hardier resistance of the other. Some plum varieties that do not have a resistance to disease are grafted onto peach rootstock which are more hardy.

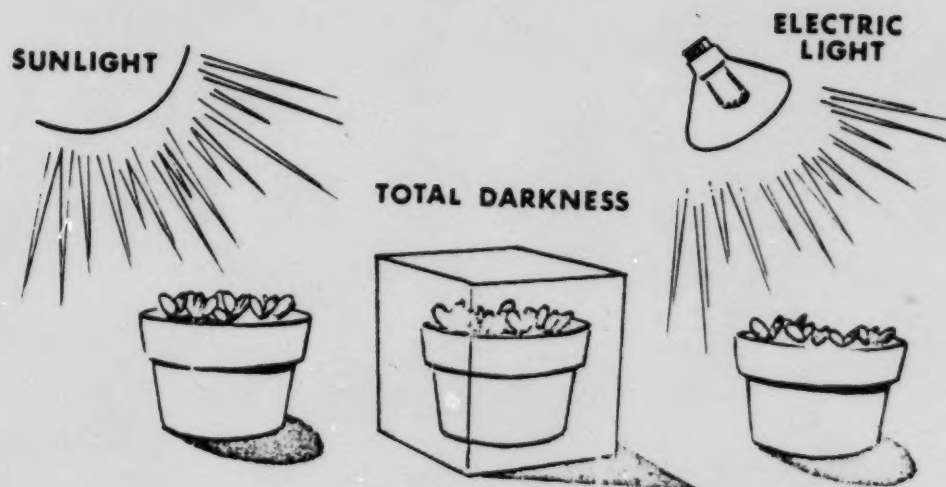
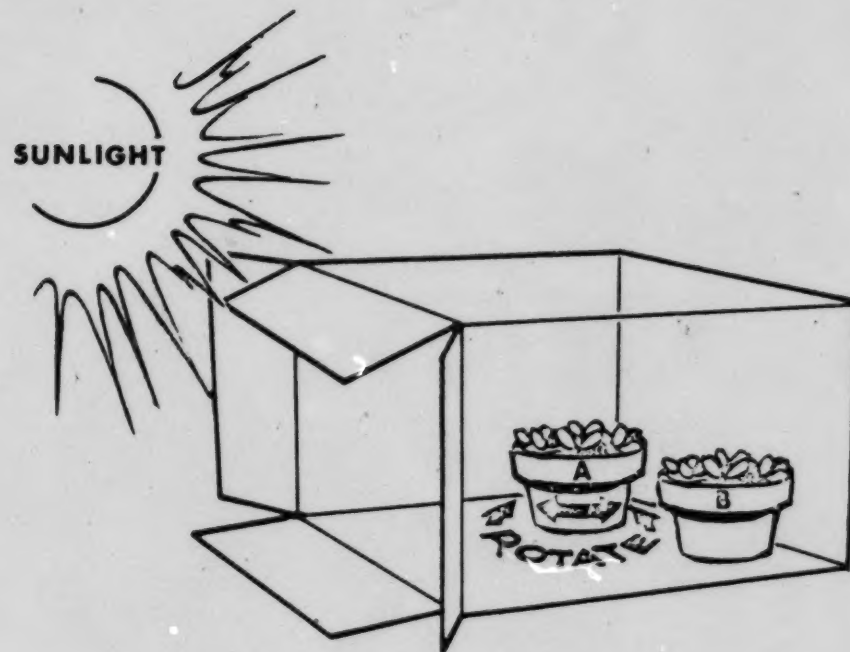
- G. Competition. Besides the continual warfare which plants carry on with disease and insect enemies, a more subtle struggle is also having constant effects - competition. Competition among plants - for light, water, soil nutrients, living space - is perhaps the most all prevading and least recognized of the ecological factors. Competition for a plant is with other plant-species (weeds) and with other individuals of its own species.

Competition can be either beneficial or harmful. Plants growing together tend to minimize many adverse climatic conditions such as unfavorable temperature, light, and air movement. For example, vetch grows faster and yeilds more when it is planted with oats. On the other hand, lettuce, if overcrowded, does not form heads but remaing in the leaf stage and is not marketable.

Cultivation is often mainly the destruction of weeds which are competing with the crop. Crop rotation also can be used to decrease competition from weeds. (Crop rotation is also helpful in controlling pests and diseases, preventing soil compaction and improving soil structure.)

Many weed pests are specific to particular crops because they are adopted to the same growing conditions as the crop they contaminate. Examples are cereal grains and wild mustard, alfalfa and white top, corn and pigweed or cheeseweed. Changing from one cultural practice to another as would occur with a crop rotation changes the environment so weeds cannot compete with an adopted crop. The same can be true with diseases and insect pests. Sugar beet nematode is not a problem providing beets are moved to a new field each year.

- H. Oxygen. Air supplies oxygen for respiration. Sometimes air becomes contaminated with gaseous materials (smog). It may be wise to move many crops from heavy industrial areas to areas of less population so contamination of the quality of the crop does not occur.



TM-6

EXERCISE 1 - LIGHT (TM-6)

2 weeks

What we are trying to discover:

How does light affect the growth of plants?

Materials:

- A. Five containers (pots, paper cups, tin cans)
- B. Seeds (bean, radish, etc.)
- C. Planting media (soil)
- D. Large cardboard box
- E. Medium sized cardboard box
- F. Labels and marking pencil
- G. Electric light

Procedure:

- A. Fill five containers half full of soil and place a like number of seeds in each container just under the soil. Water moderately.
- B. Label each container with type of seed, date and experimental treatment.
- C. Experimental Treatments
 - 1-A Place two containers in a box with the open end toward a window. Mark one container and give it a half turn every day after the seeds germinate. Do not disturb the second container.
 - 1-B Take three containers, expose one to normal light, keep the second in total darkness (covered with box) and expose the third to 24-hour light source (electric bulb).
- D. Make and record daily observations until some conclusions can be reached for each experimental treatment.

Study Questions:

- A. How did the plants in 1-A differ? Why?
- B. Should a potted plant in a window be rotated? Why?
- C. What effect does a reduced amount of light have on a plant?
- D. Is light necessary for germination?
- E. Did the amount of light have any effect on rate of germination?
- F. Did the plants with 24-hour light differ in rate

of growth from those under normal light conditions? Why?

- G. How does light affect date of flowering in certain crops? Example: Corn, wheat, tomatoes.
- H. Are plants stimulated by the amount of light or is the stimulus due to the absence of light?
- I. Why does wheat flower and produce seed in 90 days at Fairbanks, Alaska, whereas in central California it requires about twice as much time?

EXERCISE 2 - MOISTURE

10-15 days

What we are trying to discover:

How does moisture affect the germination and growth of plants?

Materials:

- A. Containers (pots, paper cups, tin cans, etc.)
- B. Seed germination trays
- C. Seeds (radishes, beans, etc.)
- D. Seedlings
- E. Planting media (soil)
- F. Labels and marking pencil
- G. Absorbent material (paper towels, cloth, cotton)

Exercise 2-A

Procedure:

- A. Place absorbent material in each of two trays.
- B. Place equal number of seeds in each.
- C. Label and add water to tray No. 1. Leave tray No. 2 dry.
- D. Place each tray in similar environment as to heat, light, aeration.
- E. Observe and record observations daily.
- F. Maintain moisture level in tray No. 1.
- G. Continue experiment until some conclusions can be reached.

Exercise 2-B

Procedure:

- A. Fill three containers with soil.
- B. Place two or three seedlings in each container.
- C. Add water to all containers to saturate planting media.
- D. Place containers in favorable environment for growth of plants.
- E. Container No. 1: Add sufficient water to keep the planting media completely saturated. Allow water to stand on top of possible by plugging the hole in the container.

Container No. 2: Maintain moisture at approximately field capacity (as much as soil will hold after draining, with no standing water left on top).

- F. Make daily observations and record results. Continue experiment until some conclusion can be reached.

Study Questions:

- A. List as many reasons as you can why water is necessary for germination.
- B. What effect does the lack of water have on the plants? Does the young plant continue to grow without the application of water? How long? Why?
- C. Did the rate of germination differ in each tray? Explain.
- D. How important is water in germination of seeds?
- E. What other conditions are necessary for germination?
- F. Does the rate of growth differ according to the moisture of the soil?
- G. What would happen if the seeds were submerged in water?
- H. What conclusions can you draw from the experiment?

EXERCISE 3 - TEMPERATURE

10-15 days

What we are trying to discover:

How important is temperature in its effect on plants?
Is there an optimum temperature for each crop? Is
there an economic way to control temperature?

Materials:

- A. Confined area (glass box) which acts as a heat trap.
- B. Controlled heat source (light bulb with water thermostat).
- C. Four containers of seedlings (6-inch pot, used milk carton)
- D. Thermometer

Procedure:

- A. Label the containers of seedlings.
- B. Place container No. 1 in temperature-controlled area. Maintain temperature at optimum level for the plant. You can select a plant that favors a room temperature 68°-70° F.
- C. Place container No. 2 in temperature-controlled area at optimum level during the day. Place in cool area (refrigerator - not freezing) at night.
- D. Place container No. 3 in an environment with varying temperatures both day and night. (Place in an outside location, provided container 3 is not in direct sunlight) Some days may be cool, others hot, or there may be changes during day. There should be definite change between day and night temperature.
- E. Place container No. 4 in a cool area (not a refrigerator) both day and night. Provide adequate light and air. Day and night temperatures may vary, but the days should be cool (below the optimum) and the nights cooler than days, generally speaking.
- F. Maintain equal moisture level in each container.
- G. Make and record daily observations of growth rate, moisture requirements of soil, and appearance of plants.
- H. Continue experiment until some definite conclusion of the effect of temperature can be reached.

Study Questions:

- A. Which container of seedlings demonstrated the most rapid growth?
- B. Which seedling demonstrated the slowest growth? Why?
- C. How did the variation of temperature affect the rate of growth?
- D. Does temperature have any effect upon flower development? Fertilization or fruit development?
- E. List plants which are regarded as "cool season" and those which are "warm season" plants.
- F. What crops are commercially produced now using temperature control? Explain why the temperature control is economic for these particular crops.
- G. What other crops could be economically produced under controlled conditions? Explain.

EXERCISE 4 - PLANT COMPETITION

What we are trying to discover:

What is the best spacing to give a particular plant?

All plants are in competition with others for light, nutrients, and air. Our crop plants compete with weeds or non-crop plants as well as among themselves. It is very important that the producers of commercial crops understand the problems that arise from over-population of plants. All plants have a certain optimum space requirement. If the growing area is small, we find a lack of production or development of a plant. In some cases this may result in an unmarketable crop. The following experiment is to familiarize you with the problems arising from over-population or over-crowding of plants.

Materials:

- A. Containers for growing plants and light soil mix.
- B. Seeds for experiment (radishes or other fast-growing plants).
- C. Labeling material.

Procedure:

- A. Fill four 6" containers within 1" of top with light soil mix.
- B. Plant seeds in containers, seeding very heavily.
- C. Label containers by number - 1,2,3,4. Note the date of planting and the dates and actions taken on succeeding steps.
- D. After 1 week: thin the plants in container 1 to allow 2" distance between plants.
- E. Thin the plants in container 2 to allow 1" distance between plants.
- F. Thin the plants in container 3 to allow 1/2" distance between plants.
- G. Do not thin plants in container 4.
- H. Make daily observation and record. Record moisture requirements.
- I. Continue at least until plants in container number 1 are of market size.

Study Questions:

- A. Did the growth rate differ in each container? How? Why?

- B. Did the plants in container number 4 develop into marketable vegetables? Explain.
- C. How did the quality and size of the plants compare among each container?
- D. How does over-crowding affect plant growth? Rate of growth? Quality of vegetable?
- E. What conclusion could you draw from the experiment?
- F. Was there a different water requirement for each container? Why?
- G. Consider the problem of weed, insect, and disease control. How does competition among plants affect these areas?
- H. Why is the removal of weeds an important item for the farmer and the home gardener?

Home Vegetable Gardening

For instruction on home vegetable gardening for freshmen, secure copies of "Growing Vegetables in the Home Garden" Extension Bulletin Number 202 from your local extension agent or from:

Bulletin Mailing Service
Industrial Building
Oregon State University
Corvallis, Oregon 97331

They will not supply multiple copies free but the charge will be minimal. Use Extension Circulars EC 884 and EC 871 to supplement Bulletin No. 202. Use EC 884 to help plan how large the garden should be and use EC 871 to identify specific varieties of vegetables which should be grown in your location. An outline on Bulletin No. 202 follows:

- I. Selecting a Site
 - A. Protecting the garden
 - B. Soil, Drainage and Sunshine
 - C. Use EC 884 - to help determine size
- II. Preparing the Soil
 - A. Organic Matter
 - B. Commercial Fertilizers
 - C. Liming
- III. Choosing Garden Tools
- IV. Arranging the Garden
 - A. Succession of Crops
 - B. Late summer and fall garden
- V. Selecting Seed
 - A. Quantity
 - B. Variety - Use EC 871 to help with variety selection
- VI. Starting the Plants
 - A. Starting Plants in the House
 - B. Special Devices for Starting Plants
 - C. Hardening Plants
 - D. Transplanting
- VII. Planting the Garden
- VIII. Caring for the Garden
 - A. Watering
 - B. Controlling Weeds
 - C. Controlling Diseases and Insects
- IX. Growing Specific Vegetables

Local Adaption --- Plant Science

HORTICULTURE UNIT

There are three Plant Science units provided in this guide:

1. Home Vegetable Production
2. Horticulture (Animal Flowers and Terrariums)
3. Alfalfa Production and Hay Quality Testing

These units are provided to allow the instructor maximum flexibility. It is suggested that the instructor and the local advisory committee select the plant science unit which best fits the local community and student needs in plant science.

HORTICULTURE UNIT

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Identify economic value of ornamental horticulture production to the state of Oregon and the local county.
2. Identify major ornamental horticultural crops grown in the local community.
3. Understand how seeds germinate and grow.
4. Understand how light effects plant growth.
5. Understand how moisture effects both germination and growth.
6. Understand how temperature effects plant growth.
7. Understand how plant competition effects plant growth.
8. Plant seed correctly.
9. Transplant seedlings correctly.
10. Lay out a plan for incorporation of flowering annuals in home landscape.
11. Develop a management plan which allows for optimum blooming and beauty of flowering annuals.
12. Design a Terrarium.

References

1. Growing Flowering Annuals, Vocational Agricultural Services, University of Illinois, 434 Mumford Hall, Urbana, Illinois 61801.
2. Care of Flowering Pot Plants in the Home, *ibid.*
3. Reblooming Flowering Gift Plants, *ibid.*

4. Exercises in Biological Principles for Agricultural Crops, Vocational Education Productions, California State Polytechnic University, San Luis Obispo, California 93407
5. Terrariums And How To Make Them, Sound Filmstrip, 1981 cost \$27.50. Available from:
 Vocational Education Productions
 California Polytechnic State University
 San Luis Obispo, California 93407
- * NOTE: Secure a copy of the above filmstrip early in the unit.
6. Plant Science, Instructional Materials Laboratory, University of Missouri, Columbia, Missouri 65201.
7. Plant Growth and Development, Ohio Agricultural Education Curriculum Materials, Ohio State University, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210.

Instructor Activities

1. A teaching outline is provided for this unit. It is left to the instructor's discretion as to whether you duplicate all, part, or none of the teaching outline for student use.
2. It is the responsibility of the instructor to identify the jobs throughout the unit which tie with the instruction being given at any particular point in the unit.
3. Exercises are provided to enhance student understanding of concepts.
4. The objectives for the unit should be related to the students in some way.
5. Statistical information about ornamental crops can be obtained at your local county extension office. For state-wide data write to:
 Stanley D. Miles, Extension Economist
 Economic Information
 219 Extension Hall
 Oregon State University
 Corvallis, Oregon 97331
6. Secure materials and equipment for exercises used; the instructor should dry-run the exercises to determine changes which need to be made and/or additional equipment necessary.
7. Assign students to develop a plan for establishing and maintaining flowering annuals in their landscapes.
8. Appendix II has optional ideas to the Flowering Annual Unit, they include: a. Care of Flowering

Pot Plants in the Home, b. Reblooming Flowering Gift Plants.

Student Activities

1. Participate in discussion and demonstrations.
2. Complete exercises assigned.
3. Apply scientific information (plant growth requirements) to ornamental crop production.
4. Start flowering annuals' seed in school greenhouse or flat as described in germinating seeds section of teaching outline (Appendix 1).
5. Seed should be sown early in the unit so transplanting to individual pots can be done toward the end of the unit.
6. Develop a plan for incorporating flowering annuals into the landscape at home.
7. Develop a management plan which will yield optimum flowering and beauty during the summer months.

Teaching Outline

Horticulture - Flowering Annuals

Introduction

The value, in gross sales, of specialty horticulture crops in Oregon for 1980 was \$110,000,000 (Instructor: Secure copies of Commodity Data Sheets and Enterprise Data Sheets in your county to determine the value of ornamental horticulture crops to your county and to determine the cost of producing those crops.)

Plant growth factors to be considered here are light, moisture, temperature, and plant competition.

Following are experiments which students can do to facilitate learning the effect and importance of light, moisture, temperature, and plant competition, or plant growth. These activities are left to the instructor's discretion. If you do use these exercises, start them early in the unit.

PLANT ECOLOGY

Plant ecology is the study of the mutual relationship between plants and the physical and biotic factors in their environment. Plants are subject to many decisive factors which control their health, growth, fruitfulness, even life itself.

What are these physical and biotic factors upon which plant life is so dependent?

- | | |
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| A. Light | E. Temperature |
| B. Soil | F. Pests and Diseases |
| C. Water | G. Competition |
| D. Nutrients | H. Oxygen |

How have producers learned to control these factors in crop production?

- A. Both the amount and type of light can be controlled in a number of ways:
 1. The "greenhouse farmer" has close control over the amount of light plants receive by either shading the green house or covering the plants during part of the daylight period or by using incandescent light sources to lengthen the daylight period.
 2. Pruning trees allows more light to reach lower branches or undergrowth.
 3. Occasionally faster growing plants are used to protect very tender plants from excessive sunlight until they are mature enough to withstand full sunlight.

4. Row spacing is controlled according to the light requirements of the crop grown.

- B. The factors of soil, water and nutrients are interrelated. This interrelation can be adjusted in many ways. For example, the type of soil determines both the water-holding capacity of that soil (which affects the amount of water available to the plant) and the amount of nutrients (such as nitrogen, potassium and phosphorus) available to the plant. Producers can change the amount of water through irrigation and its availability by breaking up hardpan and increasing percolation. They can change or modify nutrient level through the addition of fertilizers and growth of nutrient-restoring plants or aerating the soil. Producers can modify the soil type through the addition of fertilizers and growth of nutrient-restoring plants or aerating the soil. Producers can modify the soil type through the addition of organic materials such as peat moss and earth worms. Producers can improve the soil in other characteristics by adding such minerals as gypsum and sand, or such chemicals as sulphurs and sulphuric acid. The soil, water, and nutrients form a complex in fact which gives the farmer major control over the plants cultivated.

To contrast the controlling effect upon plants of flooding with water, note that rice fields are covered by up to 6" of water during germination and growth; this prevents the development of many competitive plants. Yet an excess of standing water on alfalfa will drown it.

Another example: The lack of water in desert areas has forced many plants to make adaptations which enable them to survive under very dry conditions, such as seed dormancy that can only be broken by certain levels of rainfall, extended root systems, and much thicker outer leaf coatings of waxes.

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G. Competition. Besides the continual warfare which plants carry on with disease and insect enemies, a more subtle struggle is also having constant effects - competition. Competition among plants - for light, water, soil nutrients, living space - is perhaps the most all pervading and least recognized of the ecological factors. Competition for a plant is with other plant-species (weeds) and with other individuals of its own species.

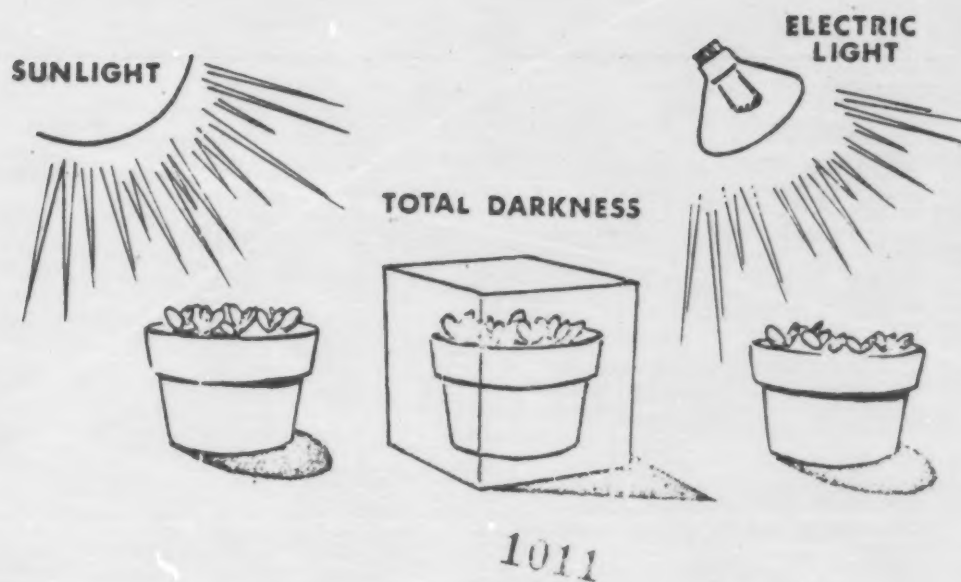
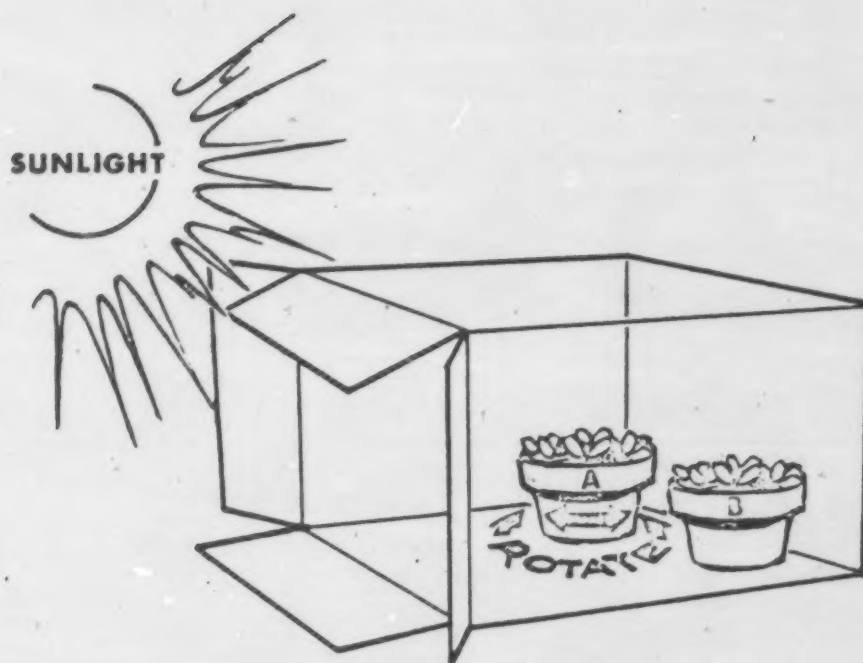
Competition can be either beneficial or harmful. Plants growing together tend to minimize many adverse climatic conditions such as unfavorable temperature, light, and air movement. For example, vetch grows faster and yields more when it is planted with oats. On the other hand, lettuce, if overcrowded, does not form heads but remains in the leaf stage and is not marketable.

Cultivation is often mainly the destruction of weeds which are competing with the crop. Crop rotation also can be used to decrease competition from weeds. (Crop rotation is also helpful in controlling pests and diseases, preventing soil compaction and improving soil structure.)

Many weed pests are specific to particular crops because they are adopted to the same growing conditions as the crop they contaminate. Examples are cereal grains and wild mustard, alfalfa and white top, corn and pigweed or cheeseweed. Changing from one cultural practice to another as would occur with a crop rotation changes the environment so weeds cannot compete with an

adopted crop. The same can be true with diseases and insect pests. Sugar beet nematode is not a problem providing beets are moved to a new field each year.

- H. Oxygen. Air supplies oxygen for respiration. Sometimes air becomes contaminated with gaseous materials (smog)



EXERCISE 1 - LIGHT

2 weeks

What we are trying to discover:

How does light affect the growth of plants? (TM-1)

Materials:

- A. Five containers (pots, paper cups, tin cans)
- B. Seeds (bean, radish, etc.)
- C. Planting media (soil)
- D. Large cardboard box
- E. Medium sized cardboard box
- F. Labels and marking pencil
- G. Electric light

Procedure:

- A. Fill five containers half full of soil and place a like number of seeds in each container just under the soil. Water moderately.
- B. Label each container with type of seed, date and experimental treatment.
- C. Experimental Treatments
 - 1-A Place two containers in a box with the open end toward a window. Mark one container and give it a half turn every day after the seeds germinate. Do not disturb the second container.
 - 1-B Take three containers, expose one to normal light, keep the second in total darkness (covered with box) and expose the third to 24-hour light source (electric bulb).
- D. Make and record daily observations until some conclusions can be reached for each experimental treatment.

Study Questions:

- A. How did the plants in 1-A differ? Why?
- B. Should a potted plant in a window be rotated? Why?
- C. What effect does a reduced amount of light have on a plant?
- D. Is light necessary for germination?

- E. Did the amount of light have any effect on rate of germination?
- F. Did the plants with 24-hour light differ in rate of growth from those under normal light conditions? Why?
- G. How does light affect date of flowering in certain crops? Example: Corn, wheat, tomatoes.
- H. Are plants stimulated by the amount of light or is the stimulus due to the absence of light?
- I. Why does wheat flower and produce seed in 90 days at Fairbanks, Alaska, whereas in central California it requires about twice as much time?

EXERCISE 2 - MOISTURE

10-15 days

What we are trying to discover:

How does moisture affect the germination and growth of plants?

Materials:

- A. Containers (pots, paper cups, tin cans, etc.)
- B. Seed germination trays
- C. Seeds (radishes, beans, etc.)
- D. Seedlings
- E. Planting media (soil)
- F. Labels and marking pencil
- G. Absorbent material (paper towels, cloth, cotton)

Exercise 2-A

Procedure:

- A. Place absorbent material in each of two trays.
- B. Place equal number of seeds in each.
- C. Label and add water to tray No.1. Leave tray No. 2 dry.
- D. Place each tray in similar environment as to heat, light, aeration.
- E. Observe and record observations daily.
- F. Maintain moisture level in tray No. 1.
- G. Continue experiment until some conclusions can be reached.

Exercise 2-B

Procedure:

- A. Fill three containers with soil.
- B. Place two or three seedlings in each container.
- C. Add water to all containers to saturate planting media.
- D. Place containers in favorable environment for growth of plants.
- E. Container No. 1: Add sufficient water to keep the planting media completely saturated. Allow water to stand on top if possible by plugging the hole in the container.

Container No. 2: Maintain moisture at approximately field capacity (as much as soil will hold after draining, with no standing water left on top).

Container No. 3: Add no additional water. Allow media in this container to become air dry.

- F. Make daily observations and record results. Continue experiment until some conclusion can be reached.

Study Questions:

- A. List as many reasons as you can why water is necessary for germination.
- B. What effect does the lack of water have on the plants: Does the young plant continue to grow without the application of water? How long? Why?
- C. Did the rate of germination differ in each tray? Explain.
- D. How important is water in germination of seeds?
- E. What other conditions are necessary for germination?
- F. Does the rate of growth differ according to the moisture of the soil?
- G. What would happen if the seeds were submerged in water?
- H. What conclusions can you draw from the experiment?

EXERCISE 3 - TEMPERATURE

10-15 days

What we are trying to discover:

How important is temperature in its effect on plants?
Is there an optimum temperature for each crop? Is
there an economic way to control temperature?

Materials:

- A. Confined area (glass box) which acts as a heat trap.
- B. Controlled heat source (light bulb with water thermostat).
- C. Four containers of seedlings (6-inch pot, used milk carton)
- D. Thermometer

Procedure:

- A. Label the containers of seedlings.
- B. Place container No. 1 in temperature-controlled area. Maintain temperature at optimum level for the plant. You can select a plant that favors a room temperature 68°-70° F.
- C. Place container No. 2 in temperature-controlled area at optimum level during the day. Place in cool area (refrigerator - not freezing) at night.
- D. Place container No. 3 in an environment with varying temperatures both day and night. (Place in an outside location, provided container 3 is not in direct sunlight) Some days may be cool, others hot, or there may be changes during day. There should be definite change between day and night temperature.
- E. Place container No. 4 in a cool area (not a refrigerator) both day and night. Provide adequate light and air. Day and night temperatures may vary, but the days should be cool (below the optimum) and the nights cooler than days, generally speaking.
- F. Maintain equal moisture level in each container.
- G. Make and record daily observations of growth rate, moisture requirements of soil, and appearance of plants.
- H. Continue experiment until some definite conclusion of the effect of temperature can be reached.

Study Questions:

- A. Which container of seedlings demonstrated the most rapid growth?
- B. Which seedling demonstrated the slowest growth? Why?
- C. How did the variation of temperature affect the rate of growth?
- D. Does temperature have any effect upon flower development? Fertilization or fruit development?
- E. List plants which are regarded as "cool season" and those which are "warm season" plants.
- F. What crops are commercially produced now using temperature control? Explain why the temperature control is economic for these particular crops.
- G. What other crops could be economically produced under controlled conditions? Explain.

EXERCISE 4 - PLANT COMPETITION

What we are trying to discover:

What is the best spacing to give a particular plant?

All plants are in competition with others for light, nutrients, and air. Our crop plants compete with weeds or non-crop plants as well as among themselves. It is very important that the producers of commercial crops understand the problems that arise from over-population of plants. All plants have a certain optimum space requirement. If the growing area is small, we find a lack of production or development of a plant. In some cases this may result in an unmarketable crop. The following experiment is to familiarize you with the problems arising from over-population or over-crowding of plants.

Materials:

- A. Containers for growing plants and light soil mix.
- B. Seeds for experiment (radishes or other fast-growing plants).
- C. Labeling material.

Procedure:

- A. Fill four 6" containers within 1" of top with light soil mix.
- B. Plant seeds in containers, seeding very heavily.
- C. Label containers by number - 1,2,3,4. Note the date of planting and the dates and actions taken on succeeding steps.
- D. After 1 week: thin the plants in container 1 to allow 2" distance between plants.
- E. Thin the plants in container 2 to allow 1" distance between plants.
- F. Thin the plants in container 3 to allow 1/2" distance between plants.
- G. Do not thin plants in container 4.
- H. Make daily observation and record. Record moisture requirements.
- I. Continue at least until plants in container number 1 are of market size.

Study Questions:

- A. Did the growth rate differ in each container? How? Why?

- B. Did the plants in container number 4 develop into marketable vegetables? Explain.
- C. How did the quality and size of the plants compare among each container?
- D. How does over-crowding affect plant growth? Rate of growth? Quality of vegetable?
- E. What conclusion could you draw from the experiment?
- F. Was there a different water requirement for each container? Why?
- G. Consider the problem of weed, insect, and disease control. How does competition among plants affect these areas?
- H. Why is the removal of weeds an important item for the farmer and the home gardener?

GROWING FLOWERING ANNUALS

What Varieties Should I Select?

Should I Buy Plants or Grow My Own From Seed?

Some Tips to Get Plants Off to A Good Start

How Do I Care For Plants After Started?

Flowering annuals are easy to grow and they do well in all parts of Oregon. They are often grouped together for massed color effect in the landscape. You can sow annual seeds directly in the beds where the plants are to bloom or you can start plants early indoors and set them out in beds after the weather warms.

You can also buy started plants of many annuals from your local nursery, garden center, greenhouse, or plant stand. These started plants usually are in bloom when they are offered for sale or have colored tag labels, which allows you to select the colors you want for your flower beds, borders, gardens, planters, or landscape schemes. It is an easy task to prepare beds and set out these started plants.

Our most reliable and important annuals provide a good display of color over a relatively long season--perhaps up to 4 months or longer. It would be difficult to get comparable continuity of color with hardy perennials. Many perennials are spring or fall blooming, and individually their main blooming seasons are usually only several weeks in duration. Because most annuals do not come into their own until late June or early July, it may be necessary to provide spring color in the flower beds with bulbs or pansies. It is, then, entirely possible to make follow-up plantings with annuals to complete the season. It is often a good plan to plant annuals among your perennials so you can have an uninterrupted display of blooms through the season.

Flowering annuals have almost every conceivable color, flower form, foliage type, and plant height you could want. The list of new and improved varieties has grown steadily. Great improvements have been made in expanded color ranges, and in vigor, uniformity, growth habit, flower form and substance, and disease resistance. Even entirely new species have become important, and the future for annuals also looks bright, considering the advance breeding techniques now being used.

In addition to these merits, annuals are quite undemanding in their cultural requirements, and diseases and insects seldom become a serious problem. The fact that the plants must be replaced each year is more than offset by the real garden or landscape value you receive from them.

What Varieties Should I Select?

Some of the major flowering annuals and some brief facts about each are as follows:

AGERATUM (*A. houstonianum*) (for sun)--F₁ hybrids are available and highly recommended over older inbred strains.

The new F_1 variety Blue Angel tops our list, but F_1 Blue Heaven is also a fine choice. Other good standard F_1 offerings: Blue Blazer, Royal Blazer, North Sea, and Summer Snow.

BEGONIA (*B. semperflorens*) (for shade)--Wax begonias are rapidly growing in importance and can be counted on for garden color over a long season when grown in light to moderate shade. F_1 hybrids are preferred in this climate. There are many excellent standard varieties to choose from. For extra large flowers, try the new F_1 Danica and F_1 Fortuna series.

BROWALLIA (*B. speciosa major*) (for shade)--This annual deserves more attention, both for beds and containers. New varieties include light-blue Sky Bells and deep-shaded Ultra Blue. Standard and good are Blue Bellis Improved and Silver Bells.

CELOSIA (*C. argentea plumosa*) (for sun)--The plumed celosias are truly excellent landscape subjects in Illinois. In the medium height class, new Red Fox is a good choice. Others worthy of your appraisal, in several height groups, include the Feather varieties, Fairy Fountains, Crusader, Golden Torch, Forest Fire Improved, and Golden Griumph.

CLEOME (*C. spinosa*) (for sun)--Where a tall-growing annual is needed, the Spider-flower is unexcelled. Variety Rose Queen, father new in the tree, is the top choice. For white flowers, choose Helen Campbell.

COLEUS (*C. blumei*) (for shade)--Most seed-grown Coleus varieties should be planted in light to moderate shade; here they attain their full glory, without being faded or burned by sun. There are dozens of fine varieties to select from, including the well-known Rainbow series. One of the most recent introductions is the Carefree series, available in nine separate colors and a mixture. These have a dwarf bushy growth habit, and rather small, finely cut leaves.

DIANTHUS (*D. chinensis*) (for sun)--The China pinks have received much attention from the plant breeders recently, and deservedly so, for they are colorful and highly useful for bedding purposes. Some of the more important recent introductions are F_1 Magic Charms (mixture and five separate colors), F_1 Snowflake, and F_1 Queen of Hearts.

GERANIUM (*Pelargonium hortorum*) (for sun)--Geraniums from seed are an important new development in the bedding plant world. There is no question that they perform excellently in outdoor plantings, usually outdistancing standard vegetatively propagated varieties. About equal in quality are the F_1 Carefree (13 separate colors) and F_1 New Era (10 colors) series. For somewhat more of a dwarf growth habit, choose F_1 Sprinter.

HIBISCUS (*H. moscheutos*) (for sun)--This subject is a hardy perennial, but since it blooms realiably and profusely in the first year from seed, it is often put into the "annual" category. F_1 Southern Belle, a color blend introduced in

1971, is a robust grower and a fine choice with flamboyant flowers up to 10 inches in diameter. In 1975 five separate color selections are also being offered.

IMPATIENS (I. wallerana) (for shade)--Here is a shade-loving bedding annual that is literally skyrocketing in popularity at present. New for 1975 are the F₁ Grande Mixture (a large-flowered dwarf) and Tange glow (an annual orange-flowered form). Many varieties with variegated flower coloration have been introduced in recent years, including F₁ Scarlet Ripple, F₁ Zig-Zag Mixture, F₁ Stars and Stripes, etc. Standard and good are such F₁ strains as the Elfin series, Imp series, Minette series, and the Shade Glow series.

MARIGOLD (T. patula and erecta) (for sun)--The dwarf French marigolds are now experiencing renewed importance, and they deserve it. Among the very best performers in our climate are the F₁ hybrid "mule-type" marigolds, including such recent introductions as Showboat, Red 7-Star, and the Nugget series. For unusually large flowers, try F₁ Mariner, new in 1975. Other fine recent introductions: the Aztec series, Honey Moon and Harvest Moon, Honeycomb and Stardust, Pumpkin Crush, and Cinnebar. Among the Tall American Marigolds, you would do well to consider F₁ Gold Galore and F₁ Happy Face. But other good less recent introductions are the F₁ Jubilee and F₁ Lady series.

NICOTIANA (N. alata grandiflora) (for sun)--Another excellent but often-overlooked hot-weather annual is the Flowering Tobacco. New for 1975 are the vigorous, medium-height F₁ hybrids Nicki-Pink and Nicki-White. Reliable standard varieties are Crimson Beeder, White Beeder, and dwarf Idol.

NIEREMEBERGIA (N. caerulea) (for sun)--The little known Dwarf Cupflower never fails to put on a good show. Variety Regal Robe is new and highly recommended, but also good are Purple Robe and Purple Robe Improved.

PANSY (Viola wittrockiana) (for shade)--Pansies are excellent for spring color, but will continue blooming on through the season, particularly if F₁ hybrids are used and partial shade provided. Some of the newest offerings are F₁ Imperial Blue and the F₁ Paramount series (mixture and 10 separate colors).

PETUNIA (P. hybrida) (for sun)--Petunias rank, unquestionably, as our most dependable, popular, and versatile bedding annual. Best for bedding are the F₁ Grandiflora singles and F₁ Multiflora singles, the latter being superior for mass color. Fine new varieties for 1975 include these F₁ Grandifloras: Blue Cloud, Blue Skies, Champagne, Ricochet, and Viva. But there are several hundred other fine choices on the market.

PORTULACA (P. grandiflora) (for sun)--The old familiar Rose Moss has undergone considerable improvement recently and now is more dependable than ever. Top choice would be the F₁ Sunglo series, but the new Sunnyside series is also recommended.

RUDBECKIA (R. herta gloriosa) (for sun)--The so-called Gloriosa Daisies are highly reliable first-year blooming perennials for this area. Rather new in the catalogs is variety Marmalade, more dwarf than the others and highly useful as a bedding annual.

SALVIA (S. splendens) (for sun)--The Red Salvias are showy, useful, and a standard item to rely on for masses of showy color. While Red Pillar (Hot Jazz) remains hard to beat, you should carefully size up the following newcomers: Red Hussar, Red Devil, Red Head, Red Baron, and F₁ Torch.

SNAPDRAGON (Antirrhinum majus) (for sun)--Snapdragons have limitations as a bedding plant, yet some of the newer dwarf and medium-height varieties have considerable merit for this purpose. Among the many fine standard varieties, the medium-height F₁ Coronette series is a rather recent introduction. For top choices in the peloric or open-faced class, you can not go wrong with any of these: F₁ dwarf Sweetheart series, F₁ Little Darling, F₁ Madame Butterfly, and F₁ Orange Pixie.

VINCA (Catharanthus rosea) (for sun)--It is hard to beat the Madagascar Periwinkle as a hot-weather annual. The limelight falls on the so-called Little series which has largely supplanted the older, taller growing varieties. Most popular of all is dwarf Little Bright Eye.

ZINNIA (Z. elegans) (for sun)--Everyone knows that Ainnias rank high up in the top-ten list of annuals. But their most serious defect is susceptibility to mildew and Alternaria leaf blight. There are literally scores of good varieties in a number of types to choose from, ranging in height from 6 inches to over 3 feet. Finest of the recent introductions have been the F₁ Peter Pans--medium height, large-flowered varieties that amaze you with their free-flowering habit and low uniform mounds that are ideal for bedding purposes. Varieties in this class introduced to date are: F₁ Peter Pan Plum Pink, Orange, Scarlet, and a mixture. Another new variety, this one in the Pumila class, is the top-rated F₁ Scarlet Ruffles.

If you have the services of a landscape architect or specialist, get their suggestions on types and varieties for the effect you want, or consult experienced gardeners of local florists, and view plantings in parks or other public areas. Also check seed catalogs, magazines, and gardening books for helpful hints, along with pictures of successful combinations. Some seed companies and public parks maintain trial gardens. By visiting these several times during the season, you can note the varieties that perform best in your area and are suited to your particular needs. In addition, these gardens may present a number of demonstration landscape settings, utilizing some of the best flowering annuals.

Should I Buy Plants Or Grow My Own From Seed?

One of the keys to growing annuals successfully is

starting with vigorous plants or seeds. Usually, buying the started plants is best, especially, if you need only a small number of plants. If you require large quantities, consider having them contract grown. Be sure to state the particular varieties you have chosen to be delivered at the date(s) you specify. Plants received in prime condition can then be set out immediately, and in a few weeks will begin providing real color. When you buy started plants, they are generally in the flowering stage of their development, but it is more important to get healthy, well-branched plants than ones with blooms.

Be sure to find out what the recommended planting time is in your area. You can not afford to have the plants killed by a late frost; furthermore, their development is slow until the ground is warmed up. Once they are established, you can usually be assured of good performance with a minimum of maintenance and care until frost in the fall, or later. A number of our popular annuals withstand hard freezes, and will continue to bloom even well into November.

If you do not want to buy started plants, the next best is to seed fresh seed where the plants are to grow. You may have fair success with some of the larger-seeded, vigorous growing types, such as marigolds and zinnias, but with petunias and most other small-seeded items, the results will be spotty and the investment in seeds usually lost. Another point to keep in mind is that plants from direct-sown seed will often bloom considerably later than thrifty, well-started plants from a greenhouse. You are also able to set started plants at the proper spacing, whereas direct-seeded plants often come up too thick and may need to be thinned.

When seeding annuals outside in early spring, check the seed package for specific recommendations. Remember seeds germinate best when the soil temperature is about 60° F. Warm soils also aid root growth. You will not necessarily get early flowers from early planting because soil temperature may be too low.

Usually the least satisfactory plan is to start your own plants indoors. However, if you should have greenhouse space or suitable conditions for growing plants, you might consider producing your own plants. But if makeshift facilities are the only ones at your disposal, it is hardly worth the effort. See the Appendix for a suggested method of starting plants from seed.

Make a plan.

The inexperienced gardener often buys plants that appeal to them and they see the plant on the plant stand. Then, after they get the plants home they have to decide where to put them. A better way would be to make a plan first, and then try to obtain the types of flowers and the colors that fit into your landscape design. If you take time to make a simple planting plan on you graph paper and a list of plants before you buy, the results of your efforts will probably be more successful. A mistake made with a

pencil and paper may be corrected in a few minutes whereas, if made with actual plant materials, it may be beyond remedy at least for that season. Furthermore, a plan helps you determine exactly how many plants you needed.



Fig. 1. Plan your beds before buying plants. Some sample plans are as follows:

- A. This is a simple red, white, and blue border 4 feet wide.
- B. This is a corner bed of mixed annuals. It can be extended any length along the sides, but should not exceed 8 feet in depth at the widest part.

Several plans are shown in Fig. 1, to give you ideas for using annual bedding plants for various types of gardens and borders. When designing your planting layout, keep some of the following things in mind: location, use, height, color of blooms, and season of flowering. The designs illustrated show the use of the tall flowers in the back, grading down to low ones in front, with various color combinations in mind. Note that plants should usually be in blocks rather than intermixed. Many other varieties or

types of plants can be used as substitutes for those shown. There are hundreds of other possible combinations and layouts. The important thing is to make a plan before buying or planting. Table 1 may be used to help you design your own individual planting layout. It contains information on some of the most common annuals used for home plantings. Some are sown directly as seeds, others are bought as started plants. Plant heights will vary somewhat according to growing conditions, but proper selection of varieties is very important. Also select plant types that are recommended for the light conditions that prevail.

Where to plant (sun or shade)

Although, there are a large number of reliable annuals from which to choose, nearly all of them perform best in full sun. Fortunately, there are some plants that do best in light to moderate shade. Some examples are: impatiens, fibrous-and tuberous-rooted begonia, browallia, seed-grown coleus, lobelia, torenia, and exacum. Caladiums, although not seed-grown, will also fit into this group of shade plants. Certain other annuals can be grown in light shade (although they ordinarily perform better in full sun): petunia, allyssum, annual phlox, salvia, snapdragon, verbena, aster, cleome, periwinkle, pansy, carnation, pinks, and balsam. (Refer to Table 1 for a more complete listing).

Some Tips To Get Plants Off To A Good Start

Buying seeds

To get a good start toward raising vigorous plants, buy good seed. Be sure your seed is fresh. Do not buy it too far in advance of planting time; for best results, allow no more than a 3-month interval. Old seed saved from previous years may lose much if its vitality under household conditions. It tends to germinate slowly and to produce poor seedlings. Keep the seed dry and cool until you plant it. Special instructions for storage are printed on some seed packets. Follow these instructions.

When buying seed, look for new varieties listed as F_1 hybrids. These are new varieties of "cultivars" developed by plant breeders from the standard annual flowers. These F_1 hybrids are produced by crossing inbred parents. Plants of F_1 varieties are usually more vigorous and uniform in color, size, and growth habit than standard varieties, and numbers and sizes of flowers often have been increased. Seeds for F_1 hybrids cost more than the seed of the usual inbred varieties, but its superiority make it worth the extra price.

Petnuias, ageratums, marigolds, zinnias, and snapdragons are just a few of the genera that are now offered as a new hybrid annuals. The vigor of these hybrids is impressive because they flower shortly after planting and continue flowering throughout the growing season.

Seed of F_2 petunia varieties is also available. These hybrids are not as vigorous as the F_1 hybrids but usually are better than the inbred varieties. This seed cost is

less than for F_1 hybrids.

Some home gardeners try to save seed from their annuals. It is best not to do this unless the seed produces plants similar to the parents of "Comes True". Saving seed from F_1 hybrids often result in inferior plants that do not resemble the parents in color, size, or growth habit.

The home gardener should also be aware that buying seeds of certain varieties is also becoming more of a problem because fewer seed companies are retailing seed packets to home gardeners. Whether you buy your seed from a garden center, greenhouse, flower shop, or through a mail order catalog, be certain to make your purchase early. The recommended and advertised varieties are usually the first to be sold out and you may be disappointed if you have to settle for substitutes. The purchase of good varieties of seed is also becoming difficult because the price of hybrid seed for many of the new varieties may limit its sale only to professional greenhouse operators.

The following is a partial list of retail "Mail-order Seedsmen." Most companies will send catalogs free on request.

Burgess Seed & Plant, Galesburg, MI 49053.
 Burnett Bros., Inc., 92 Chambers St., New York, NY 10007
 W. Atlee Burpee Company, Clinton, IA 52732
 Farmer Seed & Nursery Company, Faribault, MN 55021
 Henry Field Seed & Nursery Company, Shenandoah, IA 51601.
 Gurney Seed & Nursery Company, Yankton, SD 57078
 Joseph Harris Company, Inc., Moreton Farm, Rochester, NY 14624
 Jackson & Perkins Company, 200 Rose Lane, Medford, OR 97501
 J.W. Jung Seed Company, Randolph, WI 53956
 Earl E. May Seed & Nursery Company, Shenandoah, IA 51601
 L.L. Olds Seed Company, Box 1069, Madison, WI 53701
 Geo. W. Park Seed Company, Inc., Greenwood, SC 29646
 Seedway, Inc., Hall, NY 14463.
 R.H. Shumway, Seedsman, 628 Cedar St., Rockford, IL 61101
 Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
 Thompson & Morgan, Ltd., P.O. Box 24, Somerdal, NY 08083
 Otis S. Twilley Seed Company, Box 1817, Salisbury, MD 21801

Table 1. Information on Some Garden Annuals For Use in Home Plantings

Name	Location	Use	Height (inches)	Flower Color	Season of bloom	Space (inches) 1/2
Ageratum	Sunny or partial shade	Edging, borders cut flowers	6-18	Mainly blue, plus pink, white	Summer, fall	9-12
Alyssum	Sunny or light shade	Beds, borders, edging, window boxes, baskets	4-12	White, pink, lavender- purple	Midsummer to frost	8-12
Amaranthus	Sunny	Bedding, background	36-48	Colorful foliage	Summer, fall	18-24
Balsam (Lady's Slipper)	Sunny or semi-shade	Bedding, borders, edging	10-24	Red, pink, white, purple, salmon, bicolors	Summer & fall	12-18
Begonia (Fibrous-rooted)	Shade	Planters, low edging, bedding	6-24	White, pink, red, with green or bronze foliage Singles and a few doubles	Summer	8-12
Bells of Ireland	Sunny	Cutting	24	White with green bracts	Spring, summer	18
Browallia	Partial shade to sunny	Borders, bedding, baskets, window boxes	8-16	Blue, white	Summer, fall	6-10
Calendula	Sunny	Cutting, bedding, borders	12	Cream, gold, orange, yellow	Early summer to fall	12
Calliopsis	Sunny	Bedding, border, cutting	8-30	Yellow, orange, mahogany	Summer	8-12
Carnation (annual)	Sunny to partial shade	Cutting, bedding	15-20	White, pink, red, yellow, bicolors	Early summer to fall	8-12
Castor Bean	Sun	Border or back- ground	18-120			48
Celostia (Cockscomb)	Sunny	Cutting, border, edging, bedding, dried	8-48	Shades of red, yellow, pink, gold, orange, bicolor	Mid-summer to fall	8-12
Centaurea (Cornflower)	Sunny	Cutting, bedding, border	16-30	White, red, pink, blue, bicolor	Early to mid- summer	12
Chrysanthemum (annual)	Sunny	Cut flower, bedding	8-16	All colors, bicolors	Summer & Fall	8-12
Cleome (Spiderflower)	Sunny to partial shade	Background, bedding, cut flowers	48-60	Pink, white	Summer	12-18
Coleus	Sunny to partial shade	Edging, foliage	18-30	Many colors	All season	12-18
Cosmos	Sunny	Cutting, background	36	White, rose, crimson, orange	Mid-summer to frost	12-18
Dianthus (annual pinks)	Sunny to partial shade	Edging	8-12	Red, pink, white, variegated	Summer, fall	6-9
Dusty Miller	Sunny	Edging, foliage	6-18	Whitish green	All season	8-12
Gaillardia (annual)	Sunny	Cutting, bedding	15-20	Red, yellow, combinations	Summer, fall	12
Geranium (pied)	Sunny	Border, bedding, planters	24	Red, white, pink, salmon, bicolored	Summer, fall	12-18
Gomphrena (Globe Amaranth)	Sunny	Cutting, bedding, drying, edging	9-24	White, rose, purple, bicolor	Summer, fall	8-12

Helichrysum (Strawflower)	Sunny	Cut flowers, borders, drying	15-30	Red, bronze, gold, white	Summer	8-12
Impatiens (Saltana)	Partial shade	Planters, bedding	12-30	Red, pink, salmon, orange, purple, white, bicolor	Summer	12
Lobelia	Partial shade	Edging, window box, basket	4-8	White, blue shades	Spring, summer	6
Marigold	Sunny	Border, bedding, cutting	6-36	Orange, gold, mahogany, yellow, bicolors	Summer & fall	8-12
Matricaria (Feverfew)	Sunny to partial shade	Cutting, bedding	8-24	Yellow to white	Summer, fall	9-12
Nasturtium	Sunny	Borders, bedding cutting	12-18+	Yellow, red, salmon, orange	Summer, fall	10-18
Nicotiana (Flowering tobacco)	Sunny	Border, bedding	15-24	White, red, pink, chartreuse	Mid-summer to frost	12-15
Nierembergia (Cupflower)	Sunny	Edging, rock gardens	6-9	Blue-purple	Summer, fall	9
Pansy	Partial shade to sunny	Edging, bedding, cutting	6-12	Purple, yellow, white, red, bronze, many bicolors	Spring & Summer	6-8
Petunia	Sun to partial shade	Edging, border, planters, bedding	10-15	Bicolor, white, pink, red, salmon, blue, purple	Summer, fall	10-15
Phlox (annual)	Sunny to partial shade	Bedding, border	6-20	All but yellow	Summer, fall	8-12
Portulaca (Rose Moss)	Sunny	Edging, rock garden	6	Pink, red, white, yellow, salmon, doubles & singles	Summer, fall	8
Rudbeckia (Coneflower)	Sunny	Cutting, background	36	Yellow, gold, mahogany	Summer & fall	15
Salvia	Sunny to partial shade	Bedding, borders, cut flowers	8-30	Mauve reds, salmon, pink, violet, white	Summer, fall	9-15
Scabiosa (Pincushion flower)	Sunny	Borders, cut flowers	15-36	White, pink, blue	Summer, fall	10-15
Snapdragon	Sunny to partial shade	Cutting, borders, bedding	6-36	Bronze, pink, rose, yellow, orchid, red, white, orange, lavender	Early summer to fall	8-12
Sweet Peas	Sunny	Cutting, mostly vines on fence	12-72	All colors	Early summer	5
Verbena	Sunny to partial shade	Borders, edging, bedding	8-12	All colors but yellow	Summer to frost	9-12
Vinca (Periwinkle)	Sunny to partial shade	Borders, bedding, ground cover	6-18	White, rose-pink, white-red eye rose-red eye, rose	Summer to frost	9-15
Zinnia	Sunny	Cutting, borders bedding, edging	6-36	Red, orange, yellow, pink, white, purple, bicolors, salmon, crimson	Summer	9-12

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1/ A good rule of thumb is to leave a space between plants that will be approximately one-half of their anticipated height.

Buying started plants

When purchasing flowering annuals, insist upon good-quality plants. Be sure they are healthy, insect free, low-branched specimens of uniform height--not stunted, yellowish, or hardened up.

Most customers will pass up flats or containers of plants that are not in bloom. It is always good to know that you are getting the correct variety, as evidenced by the flowers, but it is far more important to get quality plants, even if it has been necessary to pinch out the stem tips (and flowers) to induce low branching. Plant sellers often display color photos or use container tags which accurately portray the flower type and color.

Florists use various special means to produce quality plants, including: (1) proper greenhouse temperature, (2) controlled day-lengths, (3) injection fertilization, and (4) increased carbon dioxide content of the air. In addition, they may use one of many growth-retardant chemicals, such as B-Nine, that gives low, compact growth and desirable base branching, but does not impair flowering. This also gives a lush, deep-green foliage color, which is an added advantage but may not last.

Also, insist the plants you buy have been properly "hardened off". This means that they have been gradually subjected, during the last several weeks before sale, to cooler temperatures and more rigorous environmental conditions. This is often accomplished in coldframes. This causes certain physiological changes to occur in the plants, which make them better able to withstand the shock of being transplanted into outdoor conditions.

Preparing the soil

Satisfactory results in growing annuals depend, to a large extent, on thorough preparation of the seed bed. You can make a hole or trench in the soil and plant and you will probably have flowers growing there before the season is over. However, the plants will be spindly, of poor quality, and the flowers sparse. If you check root development, it will also be poor.

However, if you prepare beds for annuals as carefully as you do for bulbs and shrubs by: (1) preparing a good seedbed--spading or using tillage equipment, (2) providing adequate drainage or soil amendments, and (3) applying fertilizer; the flowers grown there are almost certain to be outstanding. Water can enter well-prepared soil easily; seeds germinate readily; the plants grow deep, healthy roots, strong stems, and large and abundant flowers. In addition, the benefits of careful soil preparation carry over from season to season.

If you want to plant annuals in bulb beds after the bulbs have bloomed or in shrub beds for decoration while the shrubs are small, little soil preparation will be needed; bulb beds or shrub beds will already be well prepared. Incorporation of a half-inch of peat moss into the soil surface before planting annuals will also be helpful.

soil surrounding its roots and set the soil block in a planting hole. This is a safeguard against overwatering, because the top section of these pots can trap excess water.

When setting out plants in peat pots, remove the bottom to improve water drainage and rooting. These pots will breakdown in the soil and improve the soil around the plant.

Sowing seed outdoors

Annuals, seeded in the garden or directly in beds, frequently fail to germinate properly because the surface of the soil cakes and prevents entry of water. To avoid this, sow the seed in vermiculite rows or in furrows.

When planting seeds, be certain that the rows in which the seeds are to be planted are well defined and at the depth recommended on the seed package. After seeding, place approximately $\frac{1}{4}$ inch of vermiculite on larger seeds, $\frac{1}{4}$ inch for medium size seed, and a trace on smaller seeds, rather than covering them with soil. You can also improve germination by covering the seedbed with a newspaper, cheesecloth, or some similar material. This will keep the surface of the seedbed from drying out rapidly. It also will prevent erosion and discourage animals from disturbing the area until germination is completed and the seedlings are established. Keep plants moist until after germination. When the seedlings emerge remove the covering.

A very similar method is to make rows in the soil about one-half inch deep. Then, fill them with fine vermiculite and sprinkle with water. Make another shallow furrow in the vermiculite and sow the seed in this furrow. Sow it at the rate recommended on the packet. Cover the seed with a layer of vermiculite and, using a nozzle adjusted for a fine mist, water the seeded area thoroughly. This method allows you to use and transplant some of the seedlings that are planted too close together without too much root damage.

Thinning seedlings

You will enjoy seeing a vigorous stand of young seedlings, but if you do not thin them out early in the growing season, you will have disappointing results. Make your first thinning when the seedlings are beginning to form two true leaves--later thinning to the recommended spacing (Table 2). This thinning may all be done at one time or as two operations. If thinning twice, make the first thinning by removing enough seedlings that you have approximately twice as many plants left as you want to grow to full maturity. Make the second thinning when the plants are 3 to 4 inches tall. If delayed too long, the second thinning will disturb the root systems of the remaining plants. If the seedlings have been seeded in vermiculite-filled furrows, the excess seedlings can be transplanted to another spot without injury. The purpose of thinning to the recommended spacing allows the plants to have enough light, water, nutrients, and space for them to develop fully.

Zinnias are an exception to this rule of thinning. In every variety of zinnias, will appear plants with undesirable flowers of the "Mexican-hat" type. The only way to avoid having these undesirable flowers in your garden is to wait until the plants have bloomed for the first time before you thin them to their final spacing.

The recommended spacing for zinnias is 8 to 12 inches. When the plants develop two true leaves, thin them to 4 to 6 inches, transplanting the extra plants.

Then, when they bloom they will still be quite small, pull and destroy plants having the undersirable flowers. Then, thin the remaining plants to the 8-to-12-inch spacing.

Another exception to the rule for thinning is sweet alyssum. This annual is particularly susceptible to "damping-off". To insure a good stand of plants, sow the seed in hills and do not bother to thin the seedlings.

Pinching

Most of the common annuals respond well to a horticultural practice known as "pinching". To "pinch" a plant, you remove the top inch or two from its growing tip to encourage branching. If you pinch your plants, they will produce many more flowers during the growing season. This also helps to shape the plant. Started plants may already have been pinched by the greenhouse grower. Look for cut areas on the uppermost portion of the stems to see if a plant has been pinched. When you pinch flowers, you sacrifice the first bloom so that you will have more flowering branches through the growing season. Do not pinch celosia (cocks-comb), balsam, or poppy.

TABLE 2.--Planting and culture of selected garden annuals

Plant	When to plant seed	Exposure	Germination time	Plant spacing	Remarks
			Days	Inches	
Ageratum	After last frost	Semishade or full sun	5	10 to 12	Pinch tips of plants to encourage branching. Remove dead flowers. Make successive sowings for prolonged blooming period. Shade summer plantings.
Babysbreath	Early spring or in summer	Sun	10	10 to 12	
Balsam	After last frost	... do ...	10	12 to 14	
Calendula	Early spring or late fall	Shade or sun	10	8 to 10	
Calliopsis	After last frost	... do ...	8	10 to 14	
Candytuft	Early spring or late fall	... do ...	20	8 to 12	
China-aster	After last frost	... do ...	8	10 to 12	For best plants start early, grow in cold-frame. Make successive sowings for prolonged bloom.
Cockscomb	... do ...	... do ...	10	10 to 12	
Coleus	Sow indoors anytime; outdoors after last frost	Sun or partial shade	10	10 to 12	
Cornflower	Early spring	Partial shade	5	12 to 14	
Cosmos	After last frost	Sun	5	10 to 12	
Dahlia	... do ...	... do ...	5	12 to 14	For maximum bloom, sow several weeks before other annuals.
Forget-me-not	Spring or summer; shade in summer	Partial shade	10	10 to 12	
Four-o'clock	After last frost	Sun	5	12 to 14	Store roots, plant next year.
Gaillardia	Early spring through summer; shade in summer	... do ...	20	10 to 12	
Globe-amaranth	Early spring	... do ...	15	10 to 12	
Impatiens	Indoors anytime. Set out after last frost	Partial shade or deep shade	15	10 to 12	
Larkspur	Late fall in South, early spring in North	Sun	20	6 to 8	Difficult to transplant; grow in peat pots.
Lupine	Early spring or late fall	... do ...	20	6 to 8	Soak seed before planting. Guard against damping-off.
Marigold	After last frost	... do ...	5	10 to 14	High fertility delays bloom.
Morning-glory	... do ...	... do ...	5	24 to 36	Reseeds itself.

Nasturtium	... do ...	... do ...	8	8 to 12	For best flowers, grow in soil of low fertility.
Pansy	Spring or summer; shade in summer	Sun or shade	10	6 to 8	Does best in cool season.
Petunia	Late fall (in South)	Sun	10	12 to 14	Start early in spring indoors. Keep cool.
Phlox	Early spring	... do ...	10	6 to 8	Make successive plantings for prolonged bloom.
Pink	Early spring, spring or summer; shade in summer	... do ...	5	8 to 12	Start early in spring indoors. Keep cool. Remove dead flowers.
Poppy	Early spring through summer; shade in summer.	... do ...	10	6 to 10	Difficult to transplant; start in peat pots. Make successive plantings.
Portulaca	After last frost or in late fall	... do ...	10	10 to 12	
Rudbeckia	Spring or summer; shade in summer	Sun or partial shade	20	10 to 14	Perennial grown as annual. Blooms first year.
Salpiglossis	Early spring	Sun	15	10 to 12	Needs supports. Avoid cold, heavy soil.
Scabiosa	Spring or summer; shade in summer	... do ...	10	12 to 14	Keep old flowers removed.
Scarlet sage	... do ...	... do ...	15	8 to 12	
Snapdragon	Spring or late fall	... do ...	15	6 to 10	Start cool, pinch tips to encourage branching.
Spider plant	Early spring; spring, or fall	... do ...	10	12 to 14	Reseeds freely. Pinch to keep plant short. Water and fertilize freely.
Stock	... do ...	... do ...	5	6 to 10	
Strawflower	Early spring	... do ...	5	10 to 12	
Summer-cypress	... do ...	... do ...	15	18 to 24	
Sunflower	After last frost	... do ...	5	12 to 14	
Sweet alyssum	Early spring	... do ...	5	10 to 12	Damps off easily. Sow in hills, do not thin.
Sweetpea	Early spring or late summer through late fall	... do ...	15	6 to 8	Select heat-resistant types.
Verbena	After last frost	... do ...	20	18 to 24	Pinch tips often to encourage branching.
Vinca	... do ...	... do ...	15	10 to 12	Avoid overwatering.
Zinnia	... do ...	... do ...	5	8 to 12	Thin after plants begin to bloom; remove poor-flowering plants.

How Do I Care For Plants After Started?Keeping down weeds.

The day of frequent and deep cultivation is past. Whether done with a hand hoe or a power implement, cultivation should be shallow--serving mainly to "shave-off" weed seedlings and to break up the surface soil crust. Working up the soil to any depth does great damage to the root systems, but also turns up countless weed seeds that will give you trouble later on. The old "dust-mulch" theory has been fairly well debunked by our scientists, and the age of minimum tillage is here. Normally, weeding and cultivating at 10-to-14-day intervals is sufficient.

If feasible, use a mulch around your bedding annuals. In addition to holding down weeds and eliminating the need for cultivation, a good mulch conserves moisture, aids water penetration, prevents soil compaction and crusting, keeps the soil cooler, and may add organic matter to the soil. Many different mulch materials are being used, such as peat moss, ground corncobs, pecan shells, tobacco stems, shredded hardwood bark, cocoa bean hulls, compost, or peanut hulls. All of these are good, but each has its own advantages and disadvantages. If a rapidly decaying type of mulch is used (such as straw, sawdust, or even finely ground corncobs), you may need to fertilize somewhat more heavily with nitrogen.

Be certain the soil is moist and its temperature is 60° F. before you put the mulch down. Make the mulch 2 to 3 inches deep and keep it at that depth through the growing season. Do not mulch until one week after planting. This will give you time to replace plants that are not doing well. If you use an organic material for mulching, incorporate it into the soil at the end of the growing season. This will improve drainage and aeration of the soil. Use sphagnum peat moss to mulch plants that grow in partial shade. These plants have a shallow root system and need a regular water supply.

Soil fumigation, done well before planting or seeding, is another way to destroy weak seeds and the roots of perennial weeds. In addition, fumigants are sometimes used to destroy certain disease organisms, insects, and nematodes in the soil. Your agricultural occupations instructor or local garden center operator can give you suggestions on how to proceed.

Fertilization.

There is some truth in the old adage that any soil that will grow a good crop of weeds will also grow good annuals. However, you will probably be more pleased with plants grown in soil that has been properly prepared and judiciously fertilized.

While adequate amounts of phosphorus (P) and potassium (K) are essential in the soil for annuals, "caution" is the word with nitrogen (N). If in doubt, have soil tests made, then base your fertilization program on the results.

Many annuals bloom best with rather low amounts of N in the soil. With excessive nitrogen, they may produce lush foliage and rank stems, with all too few flowers. The soil pH should be near neutral (6.5 to 7.5); therefore, do not apply lime or limestone unless tests indicate that the soil is too acid.

When working up the flower beds in the spring, apply a complete dry fertilizer (such as 5-10-5 or 10-6-4) and incorporate it into the soil. Use 1 to 2 pounds per 100 square feet of flower bed area. If you use a fertilizer with a high N analysis (such as 10-6-4 or 10-10-10), apply it at the 1-pound rate. For other analysis, follow application recommendations listed on the fertilizer container.

Allowing fertilizer to be carelessly scattered over portions of the flower beds when adjacent turf areas are fertilized can lead to difficulties. Similarly, if nitrogen washes down into the beds in drainage water from a lawn area, you may also be disappointed in the performance of the affected plants. As pointed out earlier, you may get lush vegetative growth rather than flowers.

Use a starter or booster solution when setting out the plants, to get them off to a quicker start. A soluble, complete fertilizer high in phosphorus (such as 10-52-16 or 10-50-10) is often used. Mix the fertilizer in water (about 2 tablespoonsful per gallon of water), and use 1 cup of solution around the roots of each plant. If you have a fertilizer injector, water in the newly set plants with a dilute fertilizer solution.

Later if the fertility level of the soil is still low, you may need to make applications of dry or liquid fertilizers at regular intervals through the growing season. A good program is to apply $\frac{1}{2}$ to 1 pound of 5-10-5, 10-6-4, or 10-10-10 per 100 square feet every month to six weeks, as indicated by plant development.

When you fertilize, be sure the soil is moist before you apply any material. Water the beds, apply the fertilizer, then water again. Do not let dry or concentrated liquid fertilizer fall or stay on the foliage or flowers of the plants. If any does fall on the foliage or flowers, wash it off immediately because plant tissue burn may be caused. Plants growing in partial shade may require less fertilizer than those in full sunlight. Use inorganic fertilizers low in nitrogen or use organic fertilizers on shaded flowers. These plants are succulent and have very shallow, fibrous root systems that can be burned by an overdose of fertilizers. Observe your plants as they grow, because varying environmental conditions will change their fertilizer needs. Fertilize and water plants that become yellow or stunted. If plants have lush foliage and few flowers they may be getting too much fertilizer.

Watering.

If there are any real secrets for success with bedding annuals, proper watering is one of them. It would be wonderful if you could depend on rainfall entirely, but,

if rain does not come at the right time and the soil becomes moderately dry, it is time to water--and to water heavily. If using a sprinkler-type irrigation system, you may want to water continuously for a period of several hours. The length of the watering period, however, is not the important point. Water should be applied slowly and long enough that it can all penetrate the soil and soak down through the root zone, perhaps 7 to 10 inches deep. Once this has been achieved, do not rewater again until the soil has become rather dry, but well before the plants begin to wilt. During an average season at the University Trial Gardens, the sprinklers are turned on no more than 6 to 10 times. There are many weeks when they are not turned on at all.

Frequent light waterings result in shallow root formation. Then, plants wilt rather quickly on hot, dry days. If you continue with insufficient applications of water, you needlessly get yourself into a vicious circle--one that is hard to break. Plants should have extensive root systems, so they can tap the moisture reserves deeper down during periods of drouth.

You can hear many arguments among gardeners about the proper time of day to water. However, you generally have to consider convenience above most other factors. It is true, though, that water loss from evaporation will be greatest during the heat of the day. On the other hand, watering during the evening or night may encourage foliar diseases. Since you must be practical, it is recommended that watering be done when it fits best into your daily work schedule--but stopped early enough that the foliage has a chance to dry off before nightfall.

A canvas soaker hose is excellent for watering beds. Water from the soaker hose seeps directly into the soil without waste. The slow-moving water does not disturb the soil or reduce its capacity to absorb water.

Sprinklers are not as effective as soaker hoses. Water from sprinklers wets the flowers and foliage making them susceptible to diseases. Structure of the soil may be destroyed by impact of water drops falling on its surface; the soil may puddle or crust, preventing free entry of water.

The least effective method for watering is with a hand-held nozzle. Watering with a nozzle has all the objections of watering with a sprinkler. In addition, gardeners seldom are patient enough to do a thorough job of watering with a nozzle; not enough water is applied, and the water that is applied usually is poorly distributed over the bed.

Insects and diseases.

Fortunately, most kinds of bedding plants are usually not plagued by insects or serious diseases. Quite a number are especially susceptible to "damping-off" in the seed flats, but once in the garden, seldom give much trouble. Powdery mildew on zinnias is almost inevitable every summer. Sometimes, you can take advantage of

varieties that show resistance to certain diseases, e.g., rust-resistant snapdragons and wilt-resistant asters.

Soil fumigation has already been mentioned as a means of eradicating certain soil pests. You may decide to use a fumigant where disease organisms persist yearly or you normally have problems. Rotation of plantings, so the same types of plants do not grow in the same spot year after year, is another helpful way to prevent certain disease difficulties. In the fall, rake off and burn all plant debris from the beds, rather than spade it under. This material often harbors insects and disease organisms. Appropriate sprays or dusts may be used to ward off or control insects or foliar diseases. However, systemic insecticides are coming into prominence for the control of insects on outdoor ornamental plantings and will probably be used more in the future.

Maintenance practices.

Aside from the points already covered, annuals require little other special care. With a few items, careful shaping of the plants through the season will keep them in more presentable condition. It is generally not necessary to remove the old flower heads, unless they are taken off because of unsightliness. There are a few types of annuals, however, that may fail to rebloom satisfactorily unless the seed heads or spikes are removed; the snapdragon is a good example.

The petunia is one plant, however, that may need some extra attention. You may have noticed that some varieties tend to become open-centered, rangy, and matted down in mid-summer. When they reach this stage, pruning back will rejuvenate them for better performance in late summer and fall. Cut the stems back to 8 or 9 inches from the base. This can be done all at once, or a few stems at a time so that there is no drastic disruption in flowering. In a surprisingly short time, new shoot growth will occur, along with a fine showing of blooms.

Some of the important annuals need support or staking. They include the taller snapdragons, tall African marigolds, cosmos, and annual carnations.

Terrariums.

Use "Terrariums and How To Make Them" at this point in unit. Have students make a terrarium.

APPENDIX 1

GERMINATING SEEDS

Purpose:

To demonstrate an easy method of germinating seeds.

Materials:

1. A seed flat.
2. A soil mixture to fill flats (1 part loam, 1 part shredded peatmoss, 1 part sand or 2 parts garden soil, 1 part shredded peatmoss, 2 parts perlite).
3. A place to sterilize soil.
4. Vermiculite (No. 2 grade).
5. A variety of seeds to sow.
6. Thiram or captan fungicide.
7. Sphagnum moss.
8. A piece of board $\frac{1}{2}$ " thick and the length just less than the width of seed flat.

Directions:

1. Lightly cover the holes or cracks in the bottom of the flat with sphagnum moss to hold in the soil, but also to maintain adequate drainage. Fill the container up to $\frac{3}{4}$ " from the top with the soil mixture.

2. Sterilize the soil and container if at all possible. At the same time, sterilize any tools or other implements that will come into contact with the soil or vermiculite during the seeding operation.

3. Level and gently firm the soil, then moisten it by sprinkling or by setting the flat in a clean sink or deep clean pan of water. When the soil is completely saturated, remove the flat and let all excess water drain away.

4. Pour vermiculite onto the soil to a depth of $\frac{1}{2}$ inch and level carefully. For very small seeds, such as those of petunias, snapdragons, and begonias, use slightly less than $\frac{1}{2}$ inch of vermiculite. Do not pack the vermiculite. Gently wet the vermiculite layer with a fine sprinkler. Using a $\frac{1}{2}$ inch wide strip of wood, make slight depressions $\frac{1}{8}$ to $\frac{1}{4}$ inch deep in the moist vermiculite. These depressions, which should be about 2 inches apart, are the rows or "drills" into which the seed is sown.

5. Treat the seed with a protective fungicide, such as thiram or captan. These are common names for the materials, not trade names, and are listed under "active ingredients" on package labels. For each ordinary seed packet, use an amount equal to about a match head. But do not overdo it--too much can be harmful. Ballon the envelope and shake vigorously for about a minute so that

each seed gets a light dusting.

Some firms supply seeds which are already treated, and this is usually indicated on the packets. Do not treat a second time.

6. Sow the seed thinly and uniformly along the depressions. Tap the envelope with your forefinger to get the seeds to roll out at a uniform rate as you move the envelope along the row.

When planting extremely small seeds, such as those of begonia or gloxinia, sift a thin layer of finely shredded dry sphagnum moss into the depressions. Moisten, then sow the seed directly onto this material. Do not cover the seeds, but it may be well to place a piece of glass or clear plastic over the flat to retain moisture. As germination occurs, gradually lift the covering.

7. Cover the seed with a thin layer of dry vermiculite (except as mentioned in Step 6), the depth depending on the size of the seed. As a general rule, cover to a depth equal to about 3 times the diameter of the seed.

With rather small seeds (e.g., petunia, snapdragon, portulaca, and nicotiana), apply only a scattering of vermiculite particles among the seeds.

Moisten with a fine spray or mist. A light follow-up dusting of the surface with a 5 percent formulation of captan or ferbam is advised; this helps prevent recontamination, and is safe to use.

8. Place the flat in a draft-free room or greenhouse, preferably in a semishaded location. No glass covering will be needed ordinarily.

9. Water only as necessary. Check moisture twice a day. Subirrigation is good, especially for very small seeds, but a fine rose on the sprinkling can or a mist nozzle on the hose is faster and simpler. Apply water gently.

10. Move the flat to a cooler location (55°F., nights; 65°-75°F., days) when germination is complete to prevent soft, spindly growth. Choose a spot that is well ventilated and in full sunlight.

11. Transplant the seedlings as soon as they are big enough to handle conveniently. This is usually about the time the first true leaf appears between the seed leaves. Never let the plants become overgrown before "pricking off" (transplanting) into pots, bands, or flats.

Observations:

Some seeds like delphinium and larkspur should be germinated at 50°-65°F. Other seeds, such as basil, coleus, and hollyhocks, germinate better at 70°-80°F.

If damping off occurs, try to arrest it promptly by thoroughly treating the entire affected flat with a fungicide drench. Captan 50% WP or thiram 75% WP (one tablespoonful per gallon of water) makes a good drench.

Explanations:

This method takes advantage of the desirable properties of vermiculite for seed germination, while the soil supplies nutrients for the young seedlings. Vermiculite holds large quantities of water, yet retains perfect aeration. Furthermore, it is very light and easy to handle and is also sterile because it has been heat-treated. The soil-vermiculite seed flat is simple to set up, and attractive from the standpoint of cost, availability of materials, and quality of seedlings produced.

APPENDIX II

The following two references are included as potential additional material which may be covered by the class as a group or they may be used as individualized learning packets for students who have an interest in the topic.

These materials are provided here in and are available in an unedited form from Illinois. To secure additional copies, write to:

Vocational Agriculture Service
University of Illinois
434 Mumford Hall
Urbana, Illinois 61801
Phone: 217/333-3870

CARE OF FLOWERING POT PLANTS IN THE HOME

Watering	Disease and
Drainage	Insect Control
Light	Repotting
Temperature	Fertilizing
Humidity and Ventilation	Propagation

Proper care will extend the blooming period of pot plants and increase your enjoyment of them. Never overlook the fact that plants are living organisms and need favorable growing environments. The consistently successful window gardener provides the proper light, temperature, moisture, and soil conditions. Most pot plants are greenhouse-grown under almost ideal conditions, and moving them to the flower shop and then into the home may affect them adversely. Provide growing conditions as much like those in the greenhouse as possible, especially if you plan to rebloom the plants.

It is wise to buy plants that have a few flowers open and many buds. With reasonable attention, these buds will open over a considerable period of time, bringing you maximum satisfaction from your plant. Remove withered blooms to prevent seed-set from sapping the plant's strength. Take off damaged or diseased leaves and stems.

The attractiveness of most plants can be enhanced by periodic cleaning. Place the plant in the sink and gently syringe the foliage with water at room temperature, taking care that the water pressure is not excessive. If syringing is impractical, wipe smooth-surfaced leaves with a soft, damp cloth. When the foliage is quite dirty or lime-spotted, use a mild detergent in the water and follow with a clear water rinse. Clean plants in the morning if possible.

Foliage waxes and other leaf-shining materials, sold under a number of trade names, give a pleasing gloss to the leaves. These are usually safe, but it is a good idea to try them on a leaf or two to see if any damage results. If none occurs within several days, use the preparation on the entire plant, but keep it off the flowers and buds. Water plants thoroughly before using these materials, but do not use on wilted plants. Do not apply on hairy leaves, such as those of African violets or gloxinias. Brush these leaves with a soft camel's hair brush, or rinse gently with lukewarm water. Oil and milk are sometimes used to shine foliage. These are poor, however, because they clog leaf pores (stomates) and catch dust badly.

Watering

Never water plants by "rule of thumb," such as every other day, or twice a week. Give them water when they need it. Check your plants every morning--sometimes more frequently. Once the soil is thoroughly moistened, do not water again until it begins to dry out. Remember that plants in cool rooms need less water than those in a warmer, drier atmosphere. As a general rule, blooming plants and those with much foliage require larger amounts of water than those without blooms or with sparse foliage. Keep plants that are dormant (in rest period) somewhat drier. Strangely enough, soil often dries more rapidly in winter when the home is artificially heated and humidity is low than in normal summer weather.

Learn to gauge the moisture content of soil by its color and "feel." As the surface dries, it gets lighter in color. When soil is too dry, it becomes firm and sometimes cracked, especially away from the pot--but is slimy and sticky when saturated. For most plants, aim at a moderate soil-moisture content. Never allow plants to stand very long in soil that is water-logged or bone-dry. The roots will be damaged in either one. Wilting never benefited any plant.

Ordinary tap or well water is usually satisfactory for watering plants. Use it at room temperature. The chlorine and fluorine sometimes added to city water is not harmful. Rain water or melted snow is excellent, but do not use zeolite-softened water on pot plants.

Plants can be watered either from above or below, or both. If you prefer surface-watering, use a small-spouted watering can, and try to keep moisture off the foliage and out of the foliage crowns of such plants as African violets and cyclamen. Give enough water each time to soak up the entire soil ball, not just the top inch or two. If excess water drips through the drainage hole, you can be fairly certain that you are adding sufficient water.

To water a plant from the bottom, set the pot in a pan or saucer filled with water. (Dunking the pot in deep water does the job more quickly.) Moisture gradually reaches the top of the soil mass by capillary action. When the surface becomes moist, the entire soil ball is wet. Then, remove the pot and allow excess water to drain off. If you make a practice of bottom-watering, water from the top every week or two to leach out salts that accumulate on the soil surface.

When pots without drainage holes are used, always put an inch or two of coarse gravel in the bottom. Water with great caution.

Drainage

Most plants received from the florist will have adequate drainage, but it is a good idea to check the drainage hole for clogging. When repotting, arch pieces of broken pottery over the hole before putting in soil.

Drainage (continued)

Be careful not to seal the hole. Saucers placed under the plants to catch drainage water should be emptied promptly. If the pot is wrapped in waterproof material, such as tinfoil or cellophane, do not allow water to accumulate in the bottom.

Plants in jardinieres or paper-mache containers should never stand in water very long. Plants with "wet feet" soon look sick. This causes the flowers to wither, and the leaves to yellow and maybe fall. This condition is due to stagnation of the water and insufficient oxygen in the soil.

Light

Although certain plants require more light than others, all flowering plants need moderately bright light to keep them in good condition. Plants kept continuously in a poorly lighted part of a room soon show the effects of low illumination--spindly shoots, few flowers, bad foliage and flower color, and slow growth or no growth at all.

Most flowering plants need bright light the greater part of the day. South, east, or west windows (unshaded by a porch, overhang, or nearby trees) are usually best. Keep plants that are in bloom, however, out of direct sunlight. The sun's heat wilts flowers quickly.

Abrupt changes from a relatively dark location to a very bright one or vice versa, will do more damage than if the plant had a chance to become gradually acclimated to the new location. Turn plants at weekly intervals for more symmetrical growth. More information on light requirements are given later for the specific types of pot plants.

Light in the average room, well away from windows, is not bright enough for most flowering plants, even when ceiling fixtures are on. Mazda or fluorescent lamps, located fairly close to house plants, are helpful, but the heat generated by mazdas can be damaging. A plant in strong light can withstand higher temperatures than one in poor light. The latter can not produce much food, and uses up its reserves in respiration induced by the high temperatures. Never be fooled into thinking that fertilizer and water will cure a plant that really needs more light.

Temperature

Proper temperatures for pot plants are often difficult to manage in the home or hospital. A hot, dry atmosphere does more shorten blooming life than any other factor. Try to find a bright spot where temperatures will range from 65° to 75° F. during the day and between 50° to 55° F. at night. This may mean moving the plants to a cooler room at night, or placing them on a sun porch that warms up in the daytime and cools off sufficiently after sundown. At any rate, lower the thermostat at night in winter.

Temperature (continued)

A number of blooming plants should be kept somewhat warmer. These include African violets, gardenias, gloxinias, poinsettias, roses, and wax begonias. Night temperatures between 58° and 60° F. with daytime temperatures 10 to 15 degrees warmer are adequate for these plants. These recommended temperatures are based on standard greenhouse growing practices, and you should try to duplicate them as closely as possible--especially when reblooming gift plants.

In winter, plants near a window may be much cooler than those elsewhere in the room. These conditions may be all right for plants requiring lower temperatures, but could be detrimental to the warmth-loving kinds. Have a thermometer handy for checking. Pull the blinds or drapes at night during severe winter weather to protect plants near windows.

Keep plants out of either hot or cold drafts and well away from radiators, hot-air registers, and air conditioners. Plants taken outside for delivery in winter should be inner-wrapped with several thicknesses of newspaper for insulation, and a tight outer wrapper.

Humidity and Ventilation

Most homes and hospital rooms are extremely dry in winter. This situation is unhealthy both for plants and humans, and a humidifier of some kind should be installed, even if it is nothing more than evaporative pans on radiators. In the flower window, a water-tight plant tray filled with moist gravel or sand is helpful. Although occasional misting of the foliage increases humidity, it may also spread diseases. Relative humidity as high as 40 to 60 percent is desirable. Plant growth is benefited and the tender blossoms of potted plants last much longer. This level, however, is hard to attain and will likely cause excessive condensation on windows and glass doors in winter.

Plants use carbon dioxide and give off oxygen during the day, and just reverse the procedure at night. The amounts of gases involved in these exchanges are so small, however, that special ventilation is seldom required. There is no scientific basis for removing plants or cut flowers from a sick room at night, at least as far as the patient is concerned.

One good reason for ventilation is to remove harmful gases in the air. Minute amounts of natural gas and even smaller quantities of ethylene gas in the atmosphere (only a few parts per million) may seriously injure certain plants or ruin their flowers. These amounts are far too small to harm humans--or even be detected by odor. Ethylene is an ingredient of manufactured gas, and is often present in natural gas that has a little manufactured gas added to give an odor. Ethylene gas given off by very ripe fruit (especially apples and pears) and decaying vegetable matter can be equally bad in a close, poorly ventilated room.

Humidity and Ventilation

Watch for even very small leaks in gas lines, stove pipes, or chimney flues. Improper combustion of coal, kerosene, and gas stoves or furnaces may also release harmful fumes. If you suspect gas injury, plant several tomato seeds in a pot and watch the development of the seedlings. Tomato plants are extremely sensitive to these gases, and their presence will cause the leaves to arch downward abnormally and sometimes turn yellow.

Disease and Insect Control

When purchasing a gift plant, check to see that it is insect-and disease-free. Reliable florists sell only clean plants. If pests are present, they may be difficult to control under home conditions, and may spread quickly to other house plants. Both sucking-and chewing-type pests can do a great deal of damage in a short time. Always carefully inspect plants brought in from outdoors.

Occasionally syringing the plant with water at room temperature not only helps keep the foliage clean but also washes away many insects, and can be considered a minor form of insect control. Syringe in the morning, and allow the foliage to dry as quickly as possible. When you first notice insects on your plants, eradicate them before they multiply and become a real problem.

If you have only a few infested plants, you may want to buy one of the house plant insecticide formulations in an aerosol applicator. If the larger insects, such as mealybugs and scale are not too numerous, they may be eliminated by touching them with a cotton swab dipped in alcohol. Insecticides in dust form are seldom practical indoors, and they leave an unsightly residue. Burn any plant that has root-knot nematodes and sterilize the pot in boiling water for 30 minutes before reusing.

Malathion is effective in controlling many of the chewing and sucking insect pests. Follow directions and heed warnings on the package. Do not use on African violets. Space repeat applications a week to 10 days apart. Aphids sometimes called plant lice or aphids, are usually killed by one or two malathion sprayings. Mealybugs are resistant, but several applications should do the job. Hit the white cottonlike masses and all parts of the stem and leaves. Scale insects are rather tough pests too, so do not expect one dose to clean them up. In the immobile adult stage, they scarcely look like insects at all. Malathion is also effective against white flies, thrips, and springtails.

The very tiny spider mite (red spider, two-spotted mite) is not always easily eradicated. Ask your garden store operator for advice on red spider mite control. Be sure to hit the undersides of leaves, for this is where these pests usually live and do their damage. Frequently, however, you will notice the mottled appearance of the tops of the leaves before you even suspect that spider mites are present. Close examination with a hand lens may

Disease and Insect Control (continued)

reveal delicate irregular webs and mites in all stages from eggs to very active mature adults.

Proper care of plants will do much to prevent the onset of diseases. Frequent wetting of foliage encourages mildew and other fungus disorders, and may spread bacterial organisms. Overwatering encourages fungus root- and stem-rots and other soilborne diseases. Pick off any diseased or damaged plant parts. A badly diseased plant can seldom be cured, and should be destroyed. A virused plant should be discarded. The symptoms often include streaked or mottled foliage. No effective treatment is known, and virus is transmitted in cuttings or divisions made from the old plant. Destroy diseased plants by burning, or put in the garbage can for disposal. Carelessly tossing them into the garden or using them in the compost pile spreads the disease organisms promiscuously.

Repotting

As received from the florist, flowering pot plants will not need repotting unless you plan to rebloom them. Even then, certain plants, such as African violets, amaryllis, and gardenias, may not require repotting for a considerable time. When the plant becomes "root-bound" (roots massed around soil ball next to pot) or when it requires very frequent waterings, the best rule is to repot (or "shift") into a larger container.

A good general potting-soil mixture is composed of:

- 3 parts garden soil
- 2 parts shredded peatmoss, or compost
- 2 parts perlite or sand (less if soil is quite sandy)

For acid-loving plants, like azaleas and gardenias, use a higher proportion of peat. Have the mixture just moist enough that it sticks together when compressed in the hand, yet crumbles apart readily. When shifting to a larger pot, use one that is 1 to 1½ inches larger in diameter. Do not "overpot." Too large a container makes it easy to overwater a plant. Try to keep the pot and top-growth in proportion.

If possible, sterilize all soil and pots used. This practice is a real aid in controlling disease organisms, weeds, nematodes, and soil insects.

When repotting, remove some of the old soil from the top of the soil ball and any soil that comes away from the roots easily. Use care not to damage the root system unnecessarily. Arch pieces of broken pottery over the drainage hole and put some soil in the bottom of the pot. Hold the soil ball in place, centering it carefully. Keep the plant at the same depth at which it grew previously, unless it is quite "leggy" (tall and gangly). Then, set it lower in the pot. Continue adding soil around the roots and firm gently. The soil should be in close contact with all the roots, but should not be tamped so

Repotting (continued)

that it becomes compacted. Leave the surface loose.

Be sure to leave adequate "water-space." For routine waterings, the water space should hold enough water to moisten all of the soil in the pot and allow a little water to drip from the hole. The soil level should be about $\frac{3}{8}$ inch below the rim of a 3-inch pot, $\frac{1}{2}$ inch below the rim of a 4-inch pot, $\frac{3}{4}$ inch below the rim of a 6-inch pot, etc.

Water the newly repotted plant several times, making sure that the entire soil mass is thoroughly moistened. Then, wait until the soil is on the dry side before watering again. Over a period of time, top-watering tends to puddle and compact the surface. Occasionally, break up this crust with a table fork to allow better water penetration and aeration.

A wide choice of containers is available. Unglazed earthenware pots are most popular and quite inexpensive, but they require somewhat more frequent watering than glazed, plastic, or metal containers, and do not necessarily grow better plants. Avoid pots without bottom drainage holes. Proper watering is difficult in them, and drainage moisture accumulates in the bottom. Self-watering pots of various types are not too useful for most flowering pot plants.

Fertilizing

Most newly purchased plants will not need any fertilizing while in bloom. For those that are to be rebloomed, however, a regular fertilizing program is necessary.

Plants repotted in new soil can do without any supplementary fertilizing for a few weeks, or until they are well established. When used strictly according to manufacturer's directions, both the fully soluble and dry garden-type fertilizers are satisfactory. The soluble complete types especially formulated for house plants, such as Hyponex, Instant Vigoro, Plant Marvel, and Ra-Pid-Gro, are more convenient, although somewhat more expensive, than the dry garden types. Since the formulas for different brands vary widely, follow the dilution recommendations on the package. So-called "complete" fertilizers contain the three key mineral elements--nitrogen, phosphorus, and potassium.

Liquid fertilizing every 3 to 4 weeks is usually ample when the plant is growing actively. Give little or none during rest periods, and reduced amounts in winter when light intensity is low. Put on enough each time to moisten all the soil, but do not apply to dry soil.

You may also want to investigate one of the interesting slow-release fertilizers, such as MagAmp or Osmocote.

Plant response is the best indicator of fertilizer need. The experienced plantsperson learns to recognize

Fertilizing (continued)

signs of starvation or overfeeding. A stunted plant with yellowish-green lower leaves (which may drop) is usually nitrogen deficient, although improper watering practices may also cause poor lower leaves and leaf-drop. Overwatering sometimes produces new growth that is yellowish-green. Overfertilizing is also harmful. Nitrogen excess for example, induces soft, lush growth and poor flowering. Soil tests made by a reliable laboratory are helpful, but they are not very feasible for only a few plants. Very little soil can usually be taken from the pots without inflicting severe damage on the root systems.

Do not be a "fertilizer faddist." Many people mistakenly believe that only organic fertilizers should be used; but both organic and inorganic fertilizers are satisfactory sources of nutrients for house plants. Buy standard, reliable types. Ignore advice that coffee grounds, skim milk, egg shells, castor oil, and earth-worm castings will greatly benefit your potted plants. Most of these materials have little nutritional value, and some of them may actually be harmful.

Propagation

Rather than attempt to rebloom the old plant, it is sometimes better to start a new plant or two by vegetative propagation. Young shoot tips ("slips" or cuttings), 4 or 5 inches long, can usually be successfully rooted by the amateur, but some of the woodier plants will give you trouble. Remove cuttings just below a node (the point where leaf joins stem), using a sharp knife. Carefully strip all leaves from the lower 1½ inches of each cutting, but do not remove or trim the rest of the foliage. If you have hormone rooting powder, dust it over the cut surface and blow off all excess.

Stick bases of the cuttings about 1 inch deep in the rooting medium. Firm in gently and water thoroughly. The medium can be clean, sharp sand, vermiculite, perlite, or a 1-to-1 mixture of perlite or sand and granulated peatmoss. These are materials that have good aeration yet retain moisture well. Sterilize before using if possible. The medium should be constantly moist but not saturated. Be sure that drainage is adequate.

Cover each cutting with a pint fruit jar or glass tumbler to protect it from drying out. Some gardeners prefer to cover the entire pan with a plastic cake cover or a piece of polyethylene plastic to form a miniature greenhouse. Provide some ventilation to prevent moisture condensation inside. A bright (but not sunny) spot at room temperature is satisfactory for most types of cuttings during the rooting period. Pot when roots are ½ inch long.

Leaf cuttings of African violets, gloxinias, and certain begonias can be rooted in a similar way, but is

Propagation (continued)

often simpler to root leaves of the first two in water. Partially fill a tumbler with water and stretch a piece of waxed paper or aluminum foil over the top; hold in place with a rubber band. Punch holes in the covering with a pencil, and stick the leaf-stems (petioles) through the holes so that they just touch the water. In several weeks, roots and leaves will appear.

Certain easily rooted stem cuttings, such as geraniums, can also be rooted by standing them in a glass containing an inch or two of water. This is an inferior method, however, and better luck can be expected with the method described above.

Seed germination can be a troublesome procedure, particularly if "damping-off" interferes. For a simple but reliable method, see University of Illinois Circular 1077, "An Easy Method for Germinating Flower Seeds."

REBLOOMING FLOWERING GIFT PLANTS

Amaryllis	Gardenia
Aster	Geranium
Azelea	Gloxinia
Begonia	Hydrangea
Calceolaria	Jerusalem Cherry
Calla	Kalanchoe
Christmas Pepper	Poinsettia
Chrysanthemum	Primroses
Cineraria	Rose
Combination Boxes and Pots	Saintpaulia or African Violet
Cyclamen	Schizanthus
Easter Lily	Spring Bulb (hardy types)
Fuchsia	

The custom of giving flowering plants is an excellent one. Gift plants are always appropriate, whether they are bought for holidays or sent to a hospital patient, newly elected women's club president, or mother on her birthday. Flowering plants, however, are not just for holidays and special occasions--they are good buys at any time, and should become a regular decorative feature of your home, office, church, and clubs. Many of these plants have exquisite blooms, providing a "living bouquet" that outlasts cut flowers if cared for properly.

It is probably best to discard most pot plants when they are through blooming. Some of these plants require specialized growing conditions that are difficult to duplicate in the home. Quite a number of them bloom only once a year; others are seed-propagated annuals that will not flower again. Potted bulbs, such as tulips, daffodils, and hyacinths, are depleted of food and energy and seldom flower for a season or two, even when planted in a well-tended bed.

Despite these problems, many plant lovers simply refuse to toss out a choice poinsettia or azalea, or discard old bulbs in the compost pile. For those who will not change their mind, the following cultural directions are given. In many cases your efforts may be rewarded with fairly satisfactory results, but do not be disappointed if performance is not quite up to that of greenhouse-grown plants.

AMARYLLIS

(Hippeastrum hybrids) (Pronounced Am-ar-rill-iss; Hip-pee-ast-rum)

AMARYLLIS (Continued)

The stately amaryllis provides bright accent points for the flower window in late winter and early spring, and its short blooming season and scant foliage are more than compensated for by its easy culture. The blooming plants are displayed to best advantage when the pots and lower portions of the bare stalks are hidden by other greenery.

Keep blooming amaryllis in relatively cool, humid locations to enhance the lasting quality of the flowers. Bright light is not important, since there is usually little foliage at the time of flowering. Adequate watering, however, is very necessary.

The secret of getting amaryllis bulbs to rebloom year after year lies largely in summer care after flowering. Remove the withered blooms and stalks promptly, but do not cut off the leaves. Give good growing conditions indoors with full sunlight. Once the danger of frost is past in the spring, sink the pots into the soil of an outside flower bed or border where they will receive sufficient water and sunlight all summer long. Light shade during the heat of the day is probably best. Apply a soluble complete fertilizer every 4 or 5 weeks.

Amaryllis are most often neglected during the summer. Good care allows the bulb to replenish its food reserves and produce buds for another season of bloom.

Gradually withhold water before freezing weather in the fall. When the foliage has died down, trim it off and take the pots to a cool, dry, dark basement (40° to 50° F. if possible) and place them on their sides. Amaryllis need a 2-3-month rest period. Do not water or fertilize during this time. When buds begin to push out in winter or early spring, place the pots in a warm flower window (60°-65° F., nights; 70° to 75° F., days) and water well. Once in flower, put the plants in a cooler location.

Amaryllis need repotting only once every several years, and will bloom well even if somewhat pot-bound. During the rest period, remove the topsoil on each pot and replace it with a half-and-half "soil-leafmold" or "soil-compost" mixture. Use care not to disturb the root system unnecessarily. When repotting, use a pot that is 2 to 3 inches larger in diameter than the bulb itself. Provide good drainage, and use the standard potting mixture. Do not remove any firm, live roots from the bulb. Spread them well and center the bulb in the pot. Then, firm the soil around the roots. The upper $\frac{1}{2}$ to $\frac{2}{3}$ of the bulb should show above the soil surface. Have the final soil level about $\frac{3}{4}$ inch below the pot rim. Always pot amaryllis bulbs singly.

Small side-bulbs, which produce flowers identical to those of the parent bulb, can be removed and individually potted. This is the simplest means of propagation, although the commercial gradener uses other methods too. Seed pods set easily on amaryllis; but seed germination is slow, and

seedlings require 2 to 4 years to reach blooming size, even under greenhouse conditions. They also give a wide variety of flower forms and colors, many of them inferior.

When purchasing new bulbs, select large plump specimens, that are free of mold or rot. For good flowering the first season, they should be at least $2\frac{1}{2}$ inches in diameter. Amaryllis bulbs are usually potted up from October through January. It is best to keep the soil on the dry side until growth appears. Keep the potted bulbs at 60° to 70° F. and out of the sun during this period. When growth begins, move to a warm, sunny window and water more freely. Flowers up to 8 or more inches in diameter will be the reward--and only a few weeks after potting. A top-grade bulb should produce two flower stalks with at least four flowers on each.

Insects and diseases are seldom a problem with this aristocrat of the tender spring-flowering bulbs. Mealybugs and scale are the insects most often bothersome. Discard any bulbs that are diseased.

ASTER

(*Callistephus chinensis*) (Pronounced Ass-ter; Kal-liss-tef-us)

The China aster, although often plagued by several serious diseases, has long been popular as a garden flower. Florists grow it as a cut flower, and several dwarf base-branching varieties are sometimes grown as pot plants in a wide range of attractive colors. Blooming plants should be cared for much as potted chrysanthemums. If held moderately cool and in bright light, they are remarkably durable. Keep the soil uniformly moist, but avoid overwatering.

The China aster is an appealing, moderately-priced gift plant, but it should be discarded when it is through blooming. The aster is an annual, produced from seed. Successful production of potted asters require rather exacting temperatures and day-length conditions, high light intensity, and the proper selection of varieties. At present, only a few available varieties respond to this type of culture, and it is not recommended that the window gardener attempt to grow the China aster as a pot or house plant.

AZALEA

(*Thododendrion* species and hybrids) (Pronounced Az-zay-lee-uh; Roe-doe-den-dron)

The azalea's strikingly beautiful flowers in various patterns and shades of pink, rose, red, coral, salmon, and white will brighten any home or sickroom. Florists use several types for forcing, including a wide range of flower sizes and forms. Many varieties are partially double. The four major classes grown are the Indicas or Belgian azaleas, the Kurumes, the Rutherfordiana group, and the Pericats. All are handled similarly in the home. If at all possible, the azalea should be kept in a cool spot while in flower, especially at night. Although azaleas hold up amazingly well in a warm dry atmosphere, they bloom out far too quickly

and blossoms last only a short time.

Purchase plants with many buds and just a few opened flowers. In a cool situation with bright light, all buds will develop to give an almost unrivaled riot of color. Occasional syringing of foliage with tepid water is beneficial. Never let the soil dry out excessively. A good way to water an azalea when the soil has become quite dry is to submerge the pot in a deep pan of water. Leave in the water until bubbles stop rising, then remove the pot and let excess moisture drain off.

The azalea can be rebloomed, but if you do not provide the proper conditions, you are sure to fail. After blooming, remove all withered flowers and keep the plant in its cool, sunny location. It should continue to grow actively. Shift to a larger pot if the roots appear crowded. Ordinarily, azaleas do not need shifting more than once every several years. Before repotting, knock out the pot and remove some of the old soil from the roots. Use acid peat alone or a mixture of 1 part well-prepared potting soil and 3 parts acid peat. In areas where the soil is quite acid, reduce the amount of peat used.

In mid-May, put the pot in a semi-shaded, somewhat protected spot outside. Surrounding the pot with moist peat will help hold moisture in the soil ball. Do not neglect during the summer. Water and fertilize regularly, and watch for pests, such as spider mites, mealybugs, aphids, and slugs.

Chlorotic or yellow foliage is usually caused by soil that is too alkaline, with the resulting deficiency of iron. Either chelated iron or iron (ferrous) sulphate will help remedy or prevent this condition. Iron sulphate increases the acidity (lowers pH) and supplies iron. The use of ammonium sulphate fertilizer (1 scant teaspoon to 1 quart of water; or 1 ounce to 2 gallons) also aids in maintaining acidity. A convenient method is to apply both iron sulphate and ammonium sulphate at the same time ($\frac{1}{2}$ teaspoon of each to 1 quart of water; or 1 ounce of each to 3 gallons). When the plant is growing actively, apply this mixture every 2 to 3 weeks. Give only enough each time to thoroughly moisten the soil in the pot. For every third feeding, substitute a soluble complete fertilizer for the ammonium sulphate. Chelated iron and fertilizer can also be mixed and applied simultaneously. Ideally, the pH in azalea soil should be about 5.0. If your water supply is alkaline, consider using rain water.

Before midsummer (by July 1), carefully shape your azalea by removing the tips of all rapidly growing shoots. Keep the plant outdoors in the fall as long as you can, but bring it inside before frost to a very cool room with full sun. Aim at a temperature of 40° to 50° F. from November until the first of the year. An unheated sunroom or enclosed porch is ideal, or the plant may be given some protection outside in a coldframe until quite cold weather arrives. Continue to give good care during this cool period when flower buds are developing, but withhold fertilizer

and reduce watering. Without the cold treatment, probably few if any flowers would form.

As the buds continue to swell in January or early February, move the plant to a sunny window in a somewhat warmer room and apply liquid fertilizer. The temperature for forcing should be near 60°F. at night (10 to 15 degrees warmer during the day), with plenty of humidity in the air. In a few weeks, flowering begins--and your efforts will be lavishly rewarded. At excessive temperatures, buds may "blast." To prolong flowering, remove green shoots as they develop around the flower beds.

BEGONIA

(Pronounced Beg-goh-nee-uh)

Christmas Begonia (B. socotrana)

If purchased when full of buds and tended carefully, the Christmas begonia will continue blooming for weeks. This colorful gift plant is most commonly found in florist shops at Christmas time, but it is often available from September through early spring.

Give this plant bright light. Although normal room temperatures are satisfactory if the humidity is not too low, the Christmas begonia should be moved to a cooler room at night (55° to 60° F.). Attention to watering pays dividends in longer and better flowering. The most popular Christmas begonias include the familiar Lady Mac, Marjorie Gibbs, Melior, and some of the newer Norwegian varieties.

The exciting new Rieger Elatior begonias, actually a hybrid form (socotrana X tuberhybrida), are also becoming increasingly popular.

Because the Christmas begonia is so attractive, many people keep it for reblooming. The best advice is to discard this plant after it has flowered. It is a "problem crop" in the greenhouse and extremely difficult to grow well in the house.

The following directions are for those who still wish to try. Take cuttings after flowering. When well rooted, pot up in a friable soil mixture (see Wax Begonia). During the summer, give partial shade but bright illumination. If moved outside, protect the plants from wind and beating rain. Pinch in summer to encourage branching, and support as necessary. Feed and water regularly. As cool fall weather approaches, take inside to a sunny window and give full sunlight. Aim at a night temperature of 65° F., and 70° to 75° F. during the day. Since the Christmas begonia is a short-day plant, do not allow any light to strike it after dark (see Chrysanthemum). With a great deal of luck, your Christmas begonia should flower around the end of the year.

Tuberous-Rooted Begonia (B. tuberhybrida)

This summer-blooming form has become increasingly popular as a flowering pot plant because of its magnificent blooms. The doubles are of greatest interest; they are available in a number of appealing forms, such as the ruffled-, rose-, camellia-, and pendant-flowered varieties. Many have flowers 3 to 6 inches in diameter. Do not be alarmed if your plant bears two single flowers flanking the double. The singles are "female" and the double, "male." Individual blooms are very effective in corsages and rose bowls.

Put your blooming tuberous begonias in a semi-cool spot, with bright light (but not direct sun). Florists grow them at temperatures between 55° and 60° F. at night and 10 to 15 degrees warmer during the day. Never let the plants wilt because of inadequate watering, but avoid getting water on the foliage and flowers. If flowers and buds begin to fall, check these points: too high temperatures; poor drainage or over-watering; dry soil; and excess sunlight. Applications of a soluble complete fertilizer at 3-or 4-week intervals should be adequate.

Gradually withhold water in early fall. When the tops have died down, remove tubers from the soil, clean off all debris, wash, and allow to air-dry several days. Then, store in dry sand, peatmoss, or vermiculite in a cool, dry basement room (around 40° to 50° F.). An easier method is to leave the tubers in the soil. Place the pots on their sides, storing cool. Do not water.

Bring up the tubers in early spring (March or April), and start into growth in a shallow container of moist sand or vermiculite. Plant the tubers with the hollow sides up keeping the tops just above the surface. At 70° to 80° F., root and top growth start rapidly. When well on their way, pot up individually in 6-to 8-inch bulb pans. The soil mixture recommended for the wax begonia is satisfactory, although some gardeners prefer 1 part each of soil, peat or leafmold, rotted manure, and sand. Just barely cover the tops of the tubers. Grow on under the conditions listed above. Allow only several shoots to develop on each tuber.

Although tuberous begonias can be grown indoors in summer, you will probably have better success setting them into beds of planters out-of-doors in late May or June. Work in plenty of organic matter, and select a spot that is well-drained. A shady, protected location, such as along the north side of a building or wall (with full open sky) or in the light shade of a tree, is best. Stake to protect the brittle stems. Water regularly and fertilize.

Tuberous begonias can be produced from seed, but this method should be left to the specialist. Your original tuber will remain in good condition for several years. For more plants, remove and root several of the young shoots from the tuber when you start it in the spring. Leaves or leaf-segments can also be rooted, but it is better to purchase tubers. These are on the market through the early spring months. Select large, firm, top-grade tubers.

Wax, Fibrous-rooted, or Everblooming
Begonia (B. semperflorens)

The wax begonia, an old favorite, is offered in a pleasing array of colors, several height classes, and both green-and bronze-leaved forms. Vigorous and very uniform-growing F₁ hybrids are rapidly replacing the older inbreds. Florists grow the many singleflowered varieties from seed; the attractive doubles, propagated largely from cuttings, are useful mainly as novelty house plants.

The wax begonia does well as a house plant, makes an excellent but inexpensive gift item, and is a fine bedding plant for semishaded locations. You might also like to try wax begonias in an outdoor planter, window- or porch-box. They bloom continuously when doing well and last amazingly well into late fall in the garden.

If given fall sun except during the hot summer months, your potted specimen will stay in good condition and continue blooming. Provide uniform watering, regular but moderate fertilizing, and temperatures no lower than 55° to 60° F. at night. In winter, avoid an excessively hot, dry atmosphere indoors. Daytime temperatures should not exceed 70° to 75° F.

When the original plant becomes overgrown, it is quite easy to start new ones from cuttings. This method is preferable to lifting old plants from the garden in late summer for winter flowering indoors.

Although your florist starts most of his plants from seed, you will have better results if you stick to cuttings. The seed is extremely fine and delicate, requiring special germination techniques. Take tip-cuttings from around the base of the plant cuttings that have flowers or flower buds seldom make shapely plants. Root them, then pot up in a fibrous soil mixture rich in organic matter (e.g., 3 parts soil and 1 part each of screened compost, peatmoss, and sand). Shift to larger pots as needed. To encourage low branching, pinch out the tips of the main branches as the plants develop. With insufficient light, the wax begonia gets spindly and stops flowering. Lack of nitrogen causes poor foliage color and stunted growth.

CALCEOLARIA

(*C. herbeohybrida* and several hybrid forms) (Pronounced Kal-see-oh-lay-ree-uh)

The calceolaria's balloon-like flowers have earned it the name "pocket-book plant." Another common name is Slipperwort. Although the calceolaria is a spectacular pot plant, it is grown in rather limited quantities because of its shortcomings. Its care and culture is similar to that for cinerarias. Most calceolairia are grown from seed and are annuals; once through flowering they will not bloom again satisfactorily.

Your florist may have calceolarias for sale from about

Valentine's Day until June. Do not hesitate to buy calceolarias, but regard them as you would bouquets of cut flowers--to be enjoyed while they last, then discarded.

The plant is totally unsuitable for growing as a house plant. The seeds are very small, and the seedlings are fragile and susceptible to damping off. Late summer sowings are best. Indoor night temperatures of 50° to 55° F. are desirable; bud set occurs only below 60° F. Fertilize somewhat less heavily than cinerarias. On the brighter days of spring, move the plants back out of the hot sun to prevent burning of the flowers and foliage.

CALLA

(*Zantedeschia*) (Pronounced Kal-luh; Zan-ted-desh-ee-uh)

Although the calla lilly is widely admired for its classic foliage and flowers, it remains of minor importance as a pot plant. The white-flowered forms (*Z. aethiopica*) are perhaps best known, although the yellow type with white-spotted foliage (*Z. elliottiana*) is more popular as a forcing subject, particularly for Easter. A pinkish, small-flowered calla (*Z. rehmanni*) is also sometimes grown, plus several other minor forms. The so-called "flower" is actually a spathe, or protective structure for the column of true flowers inside.

Callas are rather easy to grow. They enjoy direct sun, except during the warmer months when they should get bright indirect light. Use a night temperature of 55° to 60° F. for white, and 60° to 65° F. for yellows and pinks. The normal daily temperature rise should be about 10 to 15 degrees. Plants in bloom hold their flowers longer at somewhat lower levels. With generous watering and liquid fertilizer applications at 3-to 4-week intervals, your calla should thrive--but always provide for good pot drainage. It will continue growing year-round, unless lack of water brings on dormancy.

There are several alternative methods of keeping your calla for another season. Rather than bothering with the plants all summer, many people like to dry them off by gradually withholding water in June. When the plant is dormant, store it in a cool basement room until fall without water. Or if you prefer, skip the drying-off, knock the calla out of the pot, and plant outside in late spring. Very light shade is desirable; rich soil and plenty of water are "musts." In late summer, dig, dry off, and store cool for a few weeks before repotting.

The best time for potting up or repotting is August and September for whites and November for yellows. If you buy new rhizomes, look for big healthy, top grade stock for larger flowers and more of them. Of the whites, several dwarf varieties, such as the Godfrey calla and minor, are better for pot culture. For faster starting, keep rhizomes of yellow callas in a very warm room (90°F.) for a week or two before potting.

Divide the stored thizomes, clean thoroughly, and plant singly in 4-to 6-inch pots. Discard any that show evidence of rot. For larger specimens, put several in a plant tub. Use a good porous soil mixture, such as equal parts of garden loam, peatmoss (or compost), and perlite; sterilize if possible. Cover the rhizomes with 2 to 3 inches of soil. Water and give some shade. Then, water sparingly until growth is well started. Gradually move into full sun, water more heavily, and start regular feedings when established. Remember--callas are "heavy drinkers." Shift to larger containers when potbound. Always start yellow callas at temperatures no lower than 60° to 65° F.; use the temperatures given previously for whites.

CHRISTMAS PEPPER

(*Capsicum annuum*) (Pronounced Kap-sik-um)

This is another reasonably priced pot plant, usually offered at Christmas time. It holds up quite well even at ordinary room temperatures and fits beautifully into the holiday color scheme. Handle in much the same way as Jerusalem cherries. Give good light and cool temperatures whenever possible. This annual is sold in full fruit, and should be discarded when no longer attractive. Insufficient watering causes loss of leaves and rapid disintegration of fruit. The miniature peppers can be dried for condiment purposes, but use cautiously--they are very "hot."

Christmas or ornamental peppers are easily grown from seed. Save seed from ripe pods, and dry and store for sowing in spring or early summer. Transplant seedlings into small pots, and shift when necessary into 4-5 inch pots. Use a low-nitrogen potting soil, and feed sparingly during the summer. Put the pots outside in full sun. It is a good idea to sink the pots in beds of peat to prevent the plants from drying out too rapidly. Never remove plants from their pots for planting directly into the border. Pruning and shaping are not mandatory, but you will get better developed plants from pinchings done prior to July 1. Bring indoors in fall as frost approaches. Night temperatures of 55° to 65° F. are satisfactory.

CHRYSANTHEMUM

(*C. morifolium*) (Pronounced Kriss-anth-emum)

Potted chrysanthemums ("mums") have become one of our most important and popular gift plants for all seasons. Even though the normal flowering date of most greenhouse types is November, scientific research has given the florist methods for getting mums into bloom any month of the year. They are available in a remarkably attractive range of colors and types, and they easily last for several weeks--even a month or more--if given proper care.

To insure a long period of blooming, purchase plants that still have some partially unopened buds. A pot mum dries out quickly, so check often to see if it needs watering. Place a bright or well-lighted spot (but out of full sun) to keep it in good growing condition and to produce full coloration in the opening buds. Try to find a cool location for your plant, particularly at night (60° to 65° F.), and avoid dry, overheated rooms during the day.

Hardy garden mums

Most pot mums are greenhouse varieties, and usually are not very satisfactory when planted out in the garden. Almost invariably they are frosted before blooming, and may lack winter hardiness. Garden mum varieties, however, are now also grown extensively as pot plants. If you should receive a potted mum of this type (check with your florist if you are not sure), plant it outside in your perennial border after flowering. Plants received in winter or spring can be set out as soon as the ground is warm.

Choose a sunny, well-drained location with good soil. If there is more than one plant in the pot, separate and plant singly. For well-branched, nicely shaped plants, cut off the stems an inch or two above the ground after flowering. New shoots will soon appear from the soil or stem bases. Pinch out the tips of these shoots when they reach 4 to 5 inches in length. Do the same with all later shoots produced, but discontinue by early July. These plants should bloom profusely in autumn, giving you a second flowering in the same year.

The following spring, lift the old clumps, remove well-rooted side shoots, and plant 12 to 18 inches apart in your garden. When well-budded in the fall, some of these clumps can be carefully dug up and put into large pots. Water thoroughly and protect from the sun for several days until reestablished. Keep outdoors or in a coldframe as long as possible; then bring them into a cool, bright window for flowering.

Greenhouse varieties

It is possible for the home gardener to rebloom florist-type mums, but they offer quite a challenge. If several plants were growing in the original pot, separate them after blooming and repot individually. Again, cut off the stems several inches above the soil line.

As the new shoots appear, continue to give satisfactory growing conditions--full sun and plenty of water. During the summer, sink the pots in the ground outside in a sunny, semi-protected area where they will receive adequate care. Do not forget to apply a liquid complete fertilizer every several weeks. Watch for insects. For large, well-branched specimens, pinch out or top each shoot when it attains a length of about 5 inches. Remove only the soft stem tip. The final pinch should be made no later than mid-August. Stake if necessary.

Rather than carry on the old plant or plants, many people prefer to remove some of the new shoots that develop after cutting back and root them. Otherwise, the cultural directions are the same.

Before frost, lift the plants and place in a sunny south window indoors. Night temperatures below 60° F. will interfere with budding; so aim at 60° F. at night until buds are visible, and reduce to 55° F. thereafter. Daytime temperatures should be 10 to 15 degrees higher. If you want big specimen blooms on the large-flowered varieties, remove all buds on each stem except the central one. Allow all buds to develop on the pompon or spray types.

Buds will not develop until the natural short-day/long-night conditions of fall arrive (see Poinsettia). Consequently, your mums must not be exposed to any light from a lamp or light fixture after dark--until the buds are beginning to open and show color. Even very dim light for only short periods will disrupt normal flowering. Florists artificially induce budding at other times of the year by covering their plants with light-proof black cloth from about 6 p.m. until 8 a.m. the next morning, thus, achieving the necessary photoperiod.

Although you can get florist-type mums to rebloom, do not expect your efforts to result in specimens as choice as those you can buy. For it is very difficult to provide the ideal growing conditions in your home that the greenhouse grower has at his disposal.

CINNERARIA

(*Senecio cruentus*) (Pronounced Sin-er-ray-ree-uh; Sen-nee-see-oh)

Few pot plants present as vivid an array of colors and striking patterns as the cineraria. When purchased, it is virtually a mound of flowers and buds; and with good light, plenty of water, and very cool temperatures, its blooms are remarkably long-lived.

Keep in bright light (just out of the direct sun) in the flower window. Ideal temperatures are 48° to 50° F. at night and 60° to 65° F. during the day. Cinerarias wilt if the soil is the least bit dry, so water thoroughly and often. This plant is reasonably priced, and can be purchased during the early months of the year. Since it is handled as an annual and can not be grown on, discard after flowering.

Cinerarias are always raised from seed. It is possible to grow them at home, but you would be wiser to choose other plants that make far better house plants. The cineraria is very difficult to grow under home conditions, and disease and insects are often bothersome.

If you refuse to be discouraged, proceed as follows: Buy seed, or gather the dried seed-heads from your bloomed-out plant. For winter flowering, sow in June or July.

Seedlings in late summer or fall give finished plants for the spring months. Grow seedlings in the general-purpose potting mixture, and shift to larger containers as necessary. Mature plants often need 5- to 6-inch pots.

During the summer, grow cinerarias outside in a protected place where they receive only early morning and late afternoon sun and dappled shade the rest of the day. Sink the pots into beds of peat or mulch to hold moisture. Space adequately to prevent spindly growth. Cinerarias are heavy "feeders," so apply a soluble complete fertilizer every 2 to 3 weeks. Never let them suffer from lack of water. When frost is expected, bring them inside to a sunny south window where the recommended temperatures prevail. Remember that 6 weeks at night temperatures below 60° F. are needed for flower buds to form.

COMBINATION BOXES AND POTS

Florists often make up "combinations" for Easter, Mother's Day, Memorial Day, and for general spring sales. These are living arrangements or bouquest of small, artistically assembled flowering and foliage plants. Boxes, pots, baskets, tubs, and various other containers are suitable, and plants from 2-to 3-inch pots are placed in them. The most commonly used plants are bedding annuals, such as ageratum, alyssum, browallia, celosia, impatiens, lobelia, marigold, pansy, petunia, red salvia, verbena, and wax begonia. A wide variety of other items can also be used, such as asparagus fern, chrysanthemum, coleus, fuchsia, geranium, iresine, lantana, and various tropical foliage plants.

Combinations may be remarkably attractive if well done. With proper care, they continue to bloom for several weeks. Water adequately, avoid high temperatures or dry atmosphere, and provide bright light, like that near a south or west window. Since the plants are arranged closely together in the container for a full, finished effect, they soon become greatly overcrowded and spindling. If the soil is warm, plant the annuals out in the border for continued flowering all summer long. Other plants may be potted and kept indoors, or used in window or porch boxes.

Combinations are usually moderately priced, and are sure to bring you a touch of spring and continued pleasure throughout the year.

CYCLAMEN

(*C. persicum giganteum*) (Pronounced Sik-lam-en or Sye-klam-en)

The cyclamen is an attractive plant for Christmas and the full winter season. It is usually purchased with several flowers and many buds in all stages of development. For an extended color display, give it good light (not direct sun), but cool conditions--50° to 55° F. at night; 60° to 65° F. during the day--and high humidity. An ideal place is an unshaded east window, up fairly close to the glass. To help maintain humidity, fill a large plate or broad, shallow pan with water.

Set the cyclamen on an inverted dish, just up out of the water. The evaporating water will do a great deal towards maintaining humid air around the foliage and flowers. Check soil moisture regularly. This plant requires plenty of water and good drainage. Keep water out of the foliage crowns. Handled in this way, a well-buddied specimen often continues blooming for 2 to 3 months. Bud blasting and leaf yellowing result from a hot, dry atmosphere, lack of water, or insufficient light.

Although the cyclamen is difficult to rebloom, you will be very proud if you can be successful in your attempt. To carry it over for another season, gradually withhold water after the flowers are gone. When the foliage has withered, remove the "bulb" from the soil, clean off all of the soil and debris, and store it in unmoistened peat-moss or vermiculite in a plastic bag in 50° F. temperature. Replant in good potting soil in May or June, keeping the upper half of the tuber above the surface. When well started, grow the plant in a cool, bright, protected spot outside, with partial shade during the hottest part of the day, and with the pot sunk in a bed of moist peatmoss. Through the summer, water adequately and feed about twice a month with a complete liquid fertilizer. Bring indoors before cold weather, and provide full sun and the temperatures suggested above. Flowering should occur by midwinter. With luck, your plant can be rebloomed acceptably over a period of years.

Growing cyclamen from seed is discouraged, even though this is the only method used by professional growers. Germination is slow and erratic, and 9 to 15 months are needed to produce full-sized blooming plants, even under the best greenhouse conditions.

EASTER LILY

(*Lilium longiflorum*) (Pronounced Lill-ee-um)

Easter would not seem complete without the symbolic white lily. Those grown for the holiday are selected longiflorum strains (e.g., Ace, Nellie White, and Georgia) that are best suited for greenhouse forcing. Although the Easter lily is a standard florist pot plant, it is not easy to get the bulbs into bloom successfully in the home--at least as choice specimens.

Purchased plants will hold their blooms for several weeks, if maintained in a cool, draft-free place. Give bright light, but not direct sun. Keep the soil uniformly moist, yet avoid overwatering and never let the pots stand in water for long. Removing the yellow anthers from newly opened flowers prevents the petals from being discolored with the waxy pollen. Take off old flowers promptly.

After blooming, keep the plant in a sunny window and continue watering until the foliage begins to ripen. Then, withhold water and dry off completely. When leaves have withered, cut the stem off and store pot in a cool dark place.

In mid-May, remove the bulb from the pot and plant outside in a sunny, protected, well-drained bed at a depth of 5 to 6 inches. With careful watering and feeding, it might flower again later in the season. (Do not attempt to report and force a second time because its strength has been severely sapped.) Easter lilies may survive and bloom in the garden for several years, if heavily mulched in winter, but they are not reliably hardy in Illinois.

Greenhouse conditions and precise cultural methods are necessary for forcing Easter lily bulbs to perfection, but you can bloom them with fair success in the house. Order large, plump, fresh, precooled bulbs and pot them up as soon as they arrive--usually in late fall or early winter. Use 5-to-6 in. pots, with one bulb in each. Plant deeply, with several inches of potting soil mixture over the bulb, and water it well. See that all pots have unimpaired drainage.

If the bulbs you buy come with special forcing directions, follow them to the letter. Precooled bulbs usually do not need a period of cool storage for rooting. Place the pots in your brightest window, preferably south, and strive for a night temperature of 60° F. (day temperature 10° to 15° F. higher). Water regularly but cautiously (see above). Once the stems are several inches tall, start fertilizing as a regular routine until the buds are opening. Timing for blooms at Easter is difficult, so feel lucky if you even come close. Florists use temperatures somewhat higher or lower than the recommended levels to hasten or retard bud development during the last few weeks of forcing.

FUCHSIA

(*F. hybrida*) (Pronounced Few-shuh)

Although the fuchsia is no longer one of our more popular pot plants, it is a charming subject with unusual pendant flowers. Fuchsias can be grown to give you many additional months of enjoyment. Single and double-flowered forms as well as upright-growing and trailing varieties are offered. All bloom more or less continuously. In spring, small sizes are often sold as bedding plants or used in combinations. Another familiar common name for fuchsia is Lady's Eardrops.

Fuchsias require a great deal of light but need some protection from the hot sun, especially in summer. South windows are suitable if sunlight filters through a thin curtain. Unshaded east or west windows are usually quite satisfactory. Fuchsias do best in rather cool situations. A sunroom or porch where temperatures approximate 55° to 60° F. at night is ideal; day temperatures should be 65° to 72° F.

In summer, it is usually best to plant fuchsias outside in a bright but shady bed. They make attractive companion plants for wax and tuberous-begonias, and trailing varieties are particularly well suited for porch boxes, outside planters, and hanging baskets. The soil should be well prepared, friable, and moderately rich, with plenty of moisture and perfect drainage.

In the fall, gradually allow both indoor plants and those grown outside to go dormant for a few weeks by drying them off. Water only enough to keep stems plump. Loss of foliage usually occurs. Provide cool temperatures is possible (45° to 50° F.). Another method for indoor potted fuchsias is to give them an extended rest period by cutting down on watering. With both methods, withhold all fertilizer.

After the dormant or rest period, pot the outdoor plants before freezing weather and shift the indoor plants to large pots if necessary. Remove some of the old soil from the roots. Use the standard potting mixture. Move the plants into your flower window, but water cautiously and keep out of the sun until growth is well started. When leaf buds push out, trim off all dead wood and prune back the tops severely to form a well-shaped plant. Pinch out the tips of new shoots to give good branching. Feed at several-week intervals. It is possible to raise fuchsias from seed, but new plants of named varieties are always started from stem cuttings. Insects can become bothersome on fuchsias and should be eradicated when they first appear.

GARDENIA

(*G. jasminoides*) (Pronounced Gar-deen-ee-uh)

The gardenia, with its lush green foliage and fragrant, waxy-white flowers, makes a handsome gift plant, but to grow it on successfully will tax your window-gardening abilities to the limit. Gardenias are not really very satisfactory flowering house plants, but some people keep them just for their attractive glossy leaves. The form known as *veitchi* is generally used for pot plants. It bears more flowers than the regular greenhouse varieties, although its flowers are somewhat smaller. Potted gardenias are offered for such holidays as Christmas, Easter, and Mother's Day, and other times of the year.

Uniform and exacting conditions are necessary in growing gardenias. Unless you can approximate these requirements, plan to discard your plant when it quits blooming. Give full sun in a south window during the cooler months. Provide temperatures of about 60° to 62° F. at night and 68° to 74° F. during the day. Maintain the highest humidity possible, and mist the foliage frequently. Keep uniform soil-moisture levels, but make sure there is good pot drainage. Rain water is preferable to tapwater, particularly if the latter is "hard" or alkaline. Use water at room temperature or slightly above. Maintain proper soil fertility and acidity levels at all times and check often for insects. The gardenia is a favorite haven for mealybugs, spider mites, aphids, thrips, and scale.

Before taking your gardenia outside in summer, shape it by pruning back the main shoots to several leaf pairs on each. Pruning causes branching, which results in a better

developed specimen. If rootbound, repot in a container 1 to 1½ inches larger in diameter. Use 1 part standard potting mix to 1 part acid peat.

In June, sink the pot outside in a bed of acid peat-moss. A protected locaton in partial shade is desirable. Gardenias, like azaleas and camellias, grow best in a fairly acid soil. The large amount of peat used in the potting mixture helps provide this. Fertilize at 2-to 3-week intervals with one of the complete soluble fertilizers formulated specifically for acid-loving plants. In addition, apply chelated iron periodically. If you use a soil-testing kit, check that the soil reaction (pH) is between 4.5 and 5.5. If too alkaline, an application of iron sulphate (½ ounce per gallon of water) will acidify the soil. In midsummer, pinch out the tips of newly formed shoots. Bring the plant indoors in September.

If your gardenia is kept inside all summer, protect it from the sun's rays but make certain that it gets bright light. To prevent too rapid drying out of the soil, use a glazed or non-porous pot. If the plant is in an ordinary clay pot, it can be set inside a larger pot with no less than 1 inch of space between. Fill this space with peat, sphagnum, or vermiculite and keep it wet.

Gardenias are propagated from tip cuttings taken off young shoots. Start a new plant or two when the old one becomes too large. Keep two pairs of leaves on each cutting, and use a rooting hormone. Four to six weeks are required for rooting. Put into 3-inch pots, and care for as described above.

Of the various troubles you may encounter, "bud drop" is the most irritating. Proper and uniform environmental conditions are essential to minimize this difficulty, but even then, some buds will fall. Some of the contributing factors are lack of moisture at the roots and in the air, water-logged soil, insufficient light, atmosphere too warm or too cold, and rapid temperature fluctuations. Foliage yellowing is brought on by soil that is not acid enough or by too low soil temperatures. Promptly discard any plant that has "root knots" (caused by nematodes) or is obviously diseased.

GERANIUM

(Pelargonium) (Pronounced Jey-ray-nee-un; Pel-ahr-goh-nee-um)
Garden or bedding geranium (P. hortorum)

This familiar plant is also known as the Aonal or House Geranium. Geraniums remain a favorite with window gardeners because of their showiness and rather easy propagation and culture. Attention to a few simple requirements, however, will improve the quality of the flowers and foliage.

Although geraniums are year-round bloomers, they may perform indifferently in winter if they lack light or if temperatures are too high. Relatively few geraniums are

sold as gift plants, but many of them are produced for the spring market because of their usefulness for outdoor bedding or as taller subjects in planters, tubs, window boxes, and other containers. Many plants are also sold around Memorial Day for grave and urn plantings in cemeteries.

Geraniums range from white through pink, salmon, scarlet, deep red, and various novelty colors. Semidoubles and singles are most popular, although a few fully double varieties are offered. Plant stature and foliage coloration vary greatly too. The so-called "colored" or fancy-leaf geraniums are highly attractive, but many do not have quite as perfect flower heads as the conventional varieties, and are not as well suited for garden use.

You will find that geraniums do well outside in summer with full sun but even better with light shade during the warmest part of the day and some protection. Plant in good friable soil, but do not overfertilize or overwater. In late summer or before frost in fall, make stem cuttings from the plants you want to save.

Pot rooted cuttings in small containers, and shift only when the plants start to become rootbound. Use the general-purpose mixture. Fair success can be achieved by rooting cuttings directly in small pots of sandy soil. Water cautiously, and give these cuttings the same care that you would cuttings in the rooting pan. Grow geraniums in the sunniest window you have--near the glass in winter. Without full sunlight, they get tall and stringy and have few flowers.

As the young plants develop, pinch out the tips of the branches occasionally to improve branching. Turn each week for well-formed plants, and take off old flowers as they wither. Water adequately, but carry slightly on the dry side. The preferred night temperature is 55° to 62°F., with normal room levels during the day.

Do not apply fertilizer until plants are well-established after being potted up or shifted. Feed sparingly. Too much nitrogen encourages lush growth and discourages flowering. A reddish coloration of the lower leaves is an indication of nitrogen deficiency. High humidity is not quite so important for geraniums, and they profit from good ventilation. Keep water off the leaves and flowers. If one plant becomes diseased, discard it before others are infected. Watch for insects, and eradicate them when they first appear.

Fall-propagated plants usually bloom in several months. When spring planting time arrives, set these outside for summer flowering. If you need more plants, take cuttings after the first of the year and root them. By late May or June they should be good sized specimen for setting out. For large, choice flowering geraniums for your living-room and kitchen windows in the fall and early winter, start some cuttings as early as June.

When selecting cuttings, choose those with growth that is firm and starting to mature--not soft and succulent, nor

quite woody. Avoid excess humidity around cuttings and too much water in the rooting medium. Either condition encourages disease. Geraniums can easily be raised from seed. The seed, however, is expensive and it takes a long time to get blooming sized plants. Seed-grown F₁ hybrid Carefree and New Era varieties are highly recommended for outdoor beds in full sun. Do not gamble on sowing the seed directly into flower beds. Grow your seedlings indoors or in a hotbed, or buy started plants.

Lady Washington geranium (P. domesticum)

This variety is also known as the Marth Washington, Fancy or Pansy geranium, or the Show, Royal or Regal Pelargonium. Its individual flowers, borne in clusters, are often large and attractively blotched--always bright and showy. Although Lady Washingtons are not grown much anymore, you might find them for sale from about March through May.

Keep your blooming plants in bright light, just out of the sun, with uniform but very cool temperatures and plenty of water. Unfortunately, this type of geranium is not a quality gift plant. Its petals drop quickly in the home, and the foliage is not particularly attractive in itself. In addition, it is not a perpetual bloomer like the garden geranium. Normal flowering time is in the spring, often around Easter. Plants set outside in the summer do not bloom at all in warmer areas, because buds will set only at night temperatures below about 55° F. Therefore, this species should never be bought for garden use. If you want to try reblooming your plant, here is how to do it. Enforce a rest period after flowering by cutting down on watering. In May, sink the pot to the rim in a largely sunny bed outside and keep on the dry side all summer. Lift and prune back severely in late summer, leaving only the strongest shoots, and remove a large part of the old soil from around the roots. Repot, using the general-purpose mixture. Water lightly at first, but syringe the tops frequently until new growth is well started. Keep in good light and move indoors before freezing weather. Fertilize lightly through this period.

Once inside, give the plant the conditions it needs or you will have nothing but a crop of leaves. Night temperatures of 50° to 55° F. are necessary, with about 65° to 70° F. as the daytime maximum. Full sun is equally necessary, although light shade on very bright days in spring may be advisable. Avoid over-watering and hold down on fertilizing until growth picks up in early spring. Pinch out the tips of the new shoots to promote bushiness, but discontinue after the first of the year. If roots become crowded in the pot, shift in early January.

Rather than carry over the old plant, you may prefer to start new plants from cuttings. These cuttings can be taken either soon after flowering or in late summer from new shoots that form after the plant has been pruned back. Grow these young plants outside until frost is near.

Shift and pinch them as necessary; otherwise, handle according to the cultural directions outlined above.

GLOXINIA

(*Sinningia speciosa*) (Pronounced Glok-sin-ee-uh; Sin-nin-jee-uh)

A relatively small number of greenhouse-grown flowering pot plants make satisfactory house plants, but here is one that anyone can grow successfully. In many ways, its culture is similar to that for African violets, and the tubers are handled much like the tuberous-begonia. The mound of large, velvety leaves forms a perfect background for the trumpet-shaped blooms. Each flower may be as large as 5 inches or more in diameter. Gloxinias have become so popular that florists now produce them for sale in all seasons.

The vivid colors found in gloxinias include pinks, reds, purples, blues, and whites. Some are solid-colored; others are bordered, spotted or ruffled. Double-flowered forms are also offered, as well as vigorous, early-flowering F_1 hybrid strains. Gloxinias are at their best in spring and summer, and often bloom for weeks. Never plant them in the garden. Keep indoors or on a protected porch or breeze-way in summer.

Blooming gloxinias need quite warm temperatures (65° to 70° F. at night, somewhat warmer during the day), a moist atmosphere, and good ventilation. Below 60° F. at night, growth is nil. Gloxinias can stand more light than African violets; but from late spring on, they need some shading or filtering of direct midday sun to prevent burning. You can also have good success growing them under fluorescent lights for 14 to 16 hours a day. Thin, spindly, or leggy growth occurs in too dim light. See that drainage is satisfactory. Moist but not water-logged soil is desirable. As with African violets, keep water off foliage and out of the crowns. Leaf-spotting, caused by cold water, does occur on gloxinia foliage, but not as readily as on African violets. For thrifty growth, fertilize at regular intervals.

Most types of gloxinias should gradually be allowed to go dormant after they have flowered by tapering off on watering. When foliage has died down, store the pot in a cool basement room (about 50° to 60°F.). Do not water, unless the tuber is losing its plumpness. A 6-to 10-week rest period is usually adequate but can continue up to 4 months. If new top growth starts, repot and let the plant develop.

The usual practice is to allow the plants to go dormant in late summer, and store them cool until January or February. At that time, remove the tubers from the soil and start growth in moist vermiculite or a sand-peat mixture (cupped side up), as recommended for tuberous begonias. Handle newly purchased tubers the same way. Temperature for starting tubers should be 70° to 75° F. When top and root development is well started, pot up singly in 4-inch to 5-inch pots. Plant tubers very shallowly. Allow only

the stronger topshoots to grow on each. Shift to larger pots as needed.

Azalea pots (somewhat shallower than standard pots) are well suited for gloxinias. Recommended potting mixture is 2 parts soil, 1 part peatmoss, 1 part compost or well-rotted manure, and 1 part perlite. Water sparingly at first, then, more heavily as growth increases. Plants will bloom in several months. Always allow plenty of space for well-formed plants. Bud "blasting" results from unfavorable conditions, such as improper watering, dry air, rapid temperature changes, insect injury, or disease.

Unless diseased, begonia tubers may remain in good condition for a number of years. For more plants, buy new tubers, propagate from leaf-cuttings, or root several shoots from newly started tubers. Gloxinia seed, sown in winter or early spring, gives blooming plants in 6 to 8 months, but this is not easy to accomplish under home conditions.

HYDRANGEA

(*H. macrophylla*) (Pronounced Hye-drayn-jee-uh)

The large-flowered hydrangea has become a traditional pot plant for Easter and Mother's Day. Many people keep their plants with the hope of reflowering them the following spring. This is not an impossible undertaking, but do not set your expectations very high.

With reasonable care, blooming hydrangeas will stay in good shape for several weeks in your home. The expansive foliage and huge flower clusters use much water. Dry soil hastens flower deterioration, so check soil moisture several times a day. Do not overwater or allow plant to stand in water for any extended period, however. If it wilts badly, submerge the pot in deep water until the entire soil ball is soaked up. Then, allow to drain, and replace in the flower window. Should you plan to be away for a day or so, water well and cover the entire plant with a clear plastic bag to cut down on water loss. Cool temperatures, bright light, and high humidity also increase bloom life. Try to move the plant to an even cooler room at night (50° to 60° F.). A spot near a south window, but just out of direct sun, is ideal.

To carry over for reblooming indoors, cut the plant back to 2 or 3 nodes (leaf pairs) per shoot after flowers have wilted. Repot with a soil mixture of 3 parts soil, 3 parts acid peat, and 1 part perlite. When reestablished, place in full sun. In May, sink the pot in a bed outside where it gets morning sun and light afternoon shade. Mulch, water regularly, and apply a complete soluble fertilizer every 2 weeks.

Pinch back the shoots once or twice to promote branching and to prevent tall, ungainly growth. The last pinch should be no later than mid-July. For extra-large flower heads, limit the number of stems per plant to three or four.

And lift the pots occasionally to prevent roots from growing out into surrounding soil.

Leave outside in fall until about freezing weather, then take the plant inside to a cool, sunny room (50° to 60° F.). Retain foliage until November 1, then, pick off all leaves, or put the plant in total darkness until they drop off naturally. Give the leafless plant very cool temperatures (preferably 33° to 40° F.) for at least 6 weeks, with no fertilizer. Bud development occurs during the cold treatment, so it is very essential. Meanwhile, keep the soil on the dry side, but not so dry that the stems shrivel or wilt.

Following dormancy, put the plant in a fairly cool (55° to 60° F.), bright room until leaves appear. Then, shift to a sunny window and warmer temperatures (60° F. nights, 10 to 15 degrees warmer days), and water more freely. Check soil moisture daily, and fertilize regularly.

The spectacular blooms of pot hydrangeas are usually pink or blue, depending on the soil reaction (pH). White varieties are also grown, but they do not become colored with changes in the soil pH.

Colored varieties will be blue if grown in quite acid soil (pH 4.5 to 5). For blue flowers, include liberal amounts of acid peat in the soil mix. Always use fertilizers that contain no phosphorus, such as potassium nitrate (rounded $\frac{1}{2}$ teaspoon per quart of water), at 2-week intervals in summer, and every 3 weeks during the fall and in the early spring forcing period. In addition, make 3 applications of aluminum sulphate (7 teaspoons per quart of water) at 10-day intervals in late summer. After the cold dormant treatment, give 3 or 4 similar applications. Apply aluminum sulphate only to well-moistened soil.

For pink flowers, keep the soil near neutral (pH 6.2 to 6.5). Incorporate 1 teaspoon each of superphosphate and agricultural limestone per pot. If your soil is naturally quite acid, water pots as needed with lime water ($\frac{2}{3}$ teaspoon hydrated lime per quart of water). Always use a complete liquid fertilizer, applied at the intervals given above for potassium nitrate. If iron chlorosis (foliage yellowing) appears, apply chelated iron (according to package directions) or iron sulphate ($\frac{3}{4}$ teaspoon to 1 quart of water) to clear up the symptoms.

By severely pruning back your potted hydrangea each year, you can keep it to a manageable size and flower it successfully indoors for several seasons. Stem-tip cuttings taken in spring can also be grown into blooming-sized plants by the following spring.

In milder areas, such as southern Illinois, hydrangea are winter-hardy. There your bloomed-out specimens can be planted outside in a protected spot when warm spring weather arrives, to be used as flowering shrubs. They will usually flower after mild winters, but in a severe winter, the tops may be killed back (even though the roots are alive), and will not bloom that spring. In northern Illinois hydrangeas

are not reliably hardy. However, by protecting the entire top growth over winter with styrofoam covers or mulch material, they often survive. Because the buds for spring flowering are produced the previous fall, never prune back the tops of outdoor plants later than July 15.

JERUSALEM CHERRY

(*Solanum pseudo-capsicum*) (Pronounced Sol-lay-num)

The colorful Jerusalem or Christmas cherry is an inexpensive but fairly durable florist pot plant. When purchased, it is covered with a profusion of slowly, round, orange-scarlet fruit. Give the plant bright light and hold quite cool for an extended display. Keep the soil uniformly moist, and mist the foliage occasionally. Leaves and fruit may drop prematurely if the plant wilts or if there is gas in the atmosphere. The fruit is not edible.

This plant is seldom worth keeping a second year. It often blooms poorly and becomes large and ungainly. If you do decide to rebloom your Jerusalem cherry, keep it growing actively and set it outside when the soil is warm. Choose a fairly sunny location. Either set the pot down in the soil, or knock out of the pot and plant directly. Prune the plant back severely and reshape at this time. Feed cautiously--excess nitrogen causes rank growth and poor fruiting.

The cherry-like fruits form during late summer from small white flowers that are not very attractive in themselves. Bring the plant inside in early fall and place in a sunny window with cool temperatures (50° to 55° F. at night, 10 to 15 degrees warmer days).

An even better method is to collect ripe seed from your original plant, dry it, and store, and sow in early spring. Or, you may start new plants from stem cuttings. Grow the seedlings or rooted cuttings in pots of low-nitrogen soil at 50° to 60° F. night temperatures. Set outside when danger of frost is past. Pinch out the shoot tips of the young plants for better branched, more shapely specimens, but discontinue pinching by July 1. Lift and bring indoors before frost.

KALANCHOE

(*K. blossfeldiana*) (Pronounced Kal-an-koh-ee)

Although the kalanchoe is an attractive, compact plant with clusters of small, usually scarlet-red flowers, it is not familiar to many people. The kalanchoe is ordinarily available for the winter and spring holidays, but new methods allow your florist to bring it into bloom at other times of the year. Follow the general instructions for the care of gift plants, and be on guard for mealybugs.

With average care, your kalanchoe can be kept for another season of bloom. Shift to a larger pot when rootbound, using the general-purpose potting mix. Provide for good drainage and water amply. Fertilize at 2-or 3-week intervals. Use a night temperature of 60° F. and a day temperature between

70° and 75° F.. Sink the pot outside during the summer. Pinch out shoot-tips in midsummer for compact plant development. Keep in full sunlight except for the hottest summer months when partial shade is advisable. Bring indoors before cool fall weather sets in.

In general, better plants can be obtained from cuttings or seed than by carrying over your old plant. Cuttings root easily. Those taken in spring make sizable plants for the following winter. Although more vigorous plants result from seeds, young seedlings are not the easiest subjects to nurse through the adolescent stages. Seeds may be sown from December to as late as May or June. Grow your new plants through spring and summer according to the cultural directions for carry-over plants. Since the kalanchoe forms its buds under short-day (long-night) conditions, it normally blooms in early spring. No light should strike the plants after dark from the time they are brought indoors in early fall until buds show (see Chrysanthemum).

POINSETTIS

(*Euphorbia pulcherrima*) (Pronounced Poin-set-ee-uh; Yew-forb-ee-uh)

The poinsettia, native to Mexico, is the traditional Christmas pot plant and is usually purchased in its full glory. Red-flowered forms are most popular, but white, pink, and variegated pink and white varieties are also offered. The showy colored structures we call "flowers" are actually bracts (colored leaves), while the true flowers are the yellow parts tucked down in the center of each whorl of bracts.

Few pot plants are more striking or colorful than the poinsettia, and the vastly improved varieties now being offered are amazingly durable and long lasting. Keep the room temperature between 60° and 68° F., if possible, with high humidity. Temperatures above 75° F. are very detrimental, particularly in a dry atmosphere. Put your poinsettia near a bright window, just back out of direct sunlight. Remove it from the window at night, however, if there is danger of chilling. Maintain soil moisture at moderate and uniform levels, neither soggy-wet, or bone-dry and never let the pot stand in water. Try to avoid wilting.

With good care, your plant may remain presentable for several months. Nevertheless, poinsettias are somewhat sensitive to drafts, too cool or too warm temperatures, sudden temperature changes, dry atmosphere, improper watering, and insufficient light. These conditions can lead to premature withering of bracts and leaf drop.

The poinsettia is one of the most difficult gift plants to rebloom successfully, but it is probably the one most often attempted. Unless you are willing to gamble when the odds are stacked against you, it is better not to tackle the poinsettia. Remember, too, that they bloom only once a year--although the professional grower can bring them into color almost any month of the year he chooses

with the techniques and facilities at his disposal. Florists also use dwarfing chemicals to produce compact, short-stemmed, more attractive plants for sale.

After your poinsettia has bloomed, gradually withhold water. The leaves soon turn yellow and fall. Store the dried-off plant in a cool (50° to 60° F.), dry, dark basement room until April or May. During this period, water lightly--just enough to keep the roots and stems from drying out excessively.

When the plant is brought up, prune back the stems to about 6 inches. Remove from the pot, take some old soil from the roots, then repot using a well-drained mixture (e.g., equal parts of garden loam, peatmoss, and perlite). If there are several plants in the pot, separate and pot up individually. Use a pot that holds the rootmass without crowding. Water well, and place in a warm, sunny spot for renewed growth. It is usually best to sink the pot in a protected, sunny, outside bed in May or June when danger of frost is past. Light shade during the hottest part of the day is fine. Lift occasionally to prevent growth of roots into the soil outside the pot. Shift to a larger pot as the plant becomes rootbound, but avoid unnecessary damage or disturbance to the root system.

(If you have a knack for getting cuttings to root, you may experience somewhat better results by starting new plants from the shoots that appear on your old cut-back plant in the spring.)

Keep your poinsettia growing actively all summer by watering regularly and applying a complete liquid fertilizer every 2 weeks. As new shoots form, pinch them back so that 2 nodes (leaf pairs) remain on each. Discontinue pinching in early August. Also remove some of the weaker stems completely, allowing only a few of the stonger one to develop. Be on the alert with regard to insects, and control promptly if they appear. Discard diseased plants.

Before cool weather in the fall, take the plant inside to a south window with full sun through the day. Continue good care, and work toward very uniform growing conditions. Night temperatures of 60° to 65° F. (with 70° to 75° F.) days are recommended.

The poinsettia is known as a true short-day (or long-night) plant, so it should be exposed only to natural daylight from the last week in September until bract color shows. So, make sure it receives no light after nightfall during this period from a lamp, light fixture, street light, or even a flashlight. Very brief periods of lighting at night may be enough to delay to interfere with flowering. If possible, keep the plant in a room without lights. If the room is lighted nightly, cover the plant completely at dusk every day with a piece of opaque black plastic, a cardboard box, or other light-proof cover. Remove at about 8 o'clock each morning. With luck, your poinsettia should be in bloom for the holiday season.

NOTE: Reports that the poinsettia is a poisonous plant are erroneous. Research has proven it to be harmless to humans and animals, except for certain allergic reactions that could possibly occur.

PRIMROSES

(Primula) (Pronounced Prim-rose: Prim-yew-luh)

Your florist commonly sells several species of primroses. These include P. malacoides, which has rather small flowers and leaves, and P. obconica and sinensis, both somewhat larger-flowered types. Primroses are comparatively inexpensive to buy and are available in several bright colors. They are sold from Christmas through the spring months. Select well-flowered specimens with a profusion of brds. Although primroses are actually perennials, they seldom rebloom satisfactorily and should be discarded.

It is best to put primroses where the light is good but temperatures low. For the longest possible enjoyment of these plants, the temperature should be 50° F. at night and no higher than 65° F. during the day. Primroses require considerable water, and flower heads are damaged by wilting. Avoid letting water stand around the crowns.

P. obconica sometimes causes a skin rash, so susceptible persons should avoid this species; P. sinensis is seldom grown anymore.

Propagation is by seed, but you are encouraged to buy blooming plants rather than trying to start your own. The seed is very fine and the seedlings quite fragile. Sow seeds in spring or September. Keep the plants indoors or on a sunporch with some shading in the brighter months. Primroses can not tolerate acid soil. If you use the general-purpose potting mix, substitute some other form of organic matter for at least a portion of the acid peat. Have good pot drainage, shift the plants to larger pots as necessary, keep on your toes with watering, and grow to flowering size at very cool temperatures.

ROSE

(Rosa)

Potted roses make highly appealing gift plants for the spring holidays. Most roses now being forced in pots are the small-flowered floribundas. Other types sometimes used are hybrid teas, polyantha or baby ramblers, climbers, and minatures. These are all hardy forms. Plant in the garden when the soil is warm, where they will likely continue blooming into fall and for years to come as well. Miniature roses, although generally winter hardy, can also be grown indoors over winter.

In the home, potted roses demand high light intensity, although direct sun coupled with a hot, dry atmosphere will wilt the flowers fast. Reduce the room temperature at night

to 58° to 60° F.. Give roses plenty of water, and never let them wilt. Remove old flowers, and be on the lookout for spider mites, mildew, and "black-spot." All-purpose rose dusts and sprays effectively control both insects and foliar diseases. Roses are heavy feeders, so fertilize regularly, both indoors and out. Plant outside when weather permits in deeply prepared, rich, well-drained soil with a sunny exposure. Use plenty of organic matter. Always mound up soil around the plants in late fall (or use rose cones) to prevent winter-killing. Rose fanciers like a heavy mulch both in winter and summer. Attempts to pot and flower rose plants indoors are usually disappointing, except with the miniatures.

SAINTPAULIA OR AFRICAN VIOLET

(S. hybrids) (Pronounced Saynt-pawl-ee-uh)

Few house plants have achieved the popularity of the Saintpaulia. Even so, they are somewhat unpredictable and rather exacting in their requirements. Plants are sold year-round in a wide range of colors, sizes, and foliage types. Colors include shades of blue, violet, purple, orchid, pink, and red, as well as white, bicolors, and multicolors. Many varieties bear single flowers with smooth, ruffled, or fringed petal edges, but there are also numerous fine doubles and semidoubles.

When bringing African violets home or taking them outside for delivery in cold weather, wrap extremely well. Better still, put them in a tight, insulated box to prevent chilling. Even if carefully tended, it is not uncommon for African violets to "sulk" until acclimated to their new environment. When they are situated in a location they like, they bloom almost continuously. Every home has a window that will grow excellent African violets. Try to find this right spot.

From the first, provide proper temperatures for this plant--65° to 70° F. at night and 10 to 15 degrees higher in the daytime. Night temperatures below 60° F. are undesirable. Proper light is also extremely important. Although African violets need good light, direct sun should be avoided except in deep winter. In summer, a north window is suitable, especially if not shaded by a porch or tree. As fall approaches, move to a brighter window. Too much light burns leaves and flowers, and the plant appears very compact, with abnormally light-colored foliage. When the plant is in very dim light, there may be lush growth and long leaf-stems but no flowers. Use the nature of growth as a guide in finding the proper location for your African violets. Turn the plants occasionally for symmetrical development.

Wonderful specimens can be grown under florescent lights. Use a 2-tube, 40-watt fixture with reflector; suspend with the tubes 12 to 15 inches above the plants. Light plants for 14 to 16 hours a day. If temperatures are correct, fluorescent lighting can be used in the basement or other areas where there is little or no natural lighting.

Apply lukewarm water only. When cold water touches the leaves, it usually causes leafspot, especially if the plants are in the sun. Rather than top-watering, many prefer to set the pot in a saucer of water. When you use this method, occasionally apply water from above to wash down accumulated soluble salts. Check soil moisture daily, aiming at moderate but uniform levels. Some experts believe that the soil should be kept on the dry side. At any rate, avoid overwatering or underwatering--either will interfere with flowering. Keep the humidity up for best plant performance.

African violets need a light potting soil that drains well and provides good aeration. The general-purpose potting mixture will be satisfactory. Apply a soluble complete fertilizer at intervals of several weeks. Modify the frequency and strength of applications as indicated by the plant's progress. Overfertilization quickly leads to failure.

Shift to a larger container only when the roots become matted around the sides of the soil ball. It is best to divide the old plant into single-crown divisions when it becomes too large or crowded. Propagation is also by leaf-cuttings, but this method takes much longer to produce blooming-sized plants. African violet seed can be purchased, but is very fine and rather difficult to germinate successfully.

Clean your plant by cautiously syringing with lukewarm water every 3 or 4 weeks. Dust and debris can be removed from the hairy leaves with a camel's hair brush, but brush gently. Gas in the atmosphere is said to be very bad for African violets. If the plants are in clay pots, cover the rim with tinfoil or scotch tape to protect the petioles (leaf-stems) from soluble salt injury or damage from the rough edges.

SCHIZANTHUS Or BUTTERFLY FLOWER

(Pronounced Skye-zanth-us)

The schizanthus, native to Chile, is now grown so infrequently that it is almost a "stranger" in florist shops. Late winter or spring is the season for it. Another common name for the schizanthus is the "poor man's orchid." There is no denying that it is a flashy plant with its myriads of attractively patterned flowers and lacy foliage. Try cutting a few springs for table arrangements or bouquets. Although somewhat fragile, they last remarkable well in water.

Your florist grows schizanthus as a cool-house crop, and you should give it as similar conditions as possible. The temperature at night should be about 50° F., and daytime temperatures should range between 60° and 70° F.. With such a mound of flowers and leaves, it is necessary to check on watering every morning. So that all buds have a chance to open, keep the plant growing normally in bright light but not direct sun. High humidity help too.

The schizanthus is an annual grown from seed. It blooms only once, so discard your plant after the flowers have withered. Blooming plants are inexpensive in season, and it is scarcely worth the trouble trying to raise your own.

However, if you want to try your hand at it, gather seed from your dried-off plant, or buy seed of semidwarf strains. Sow the seed in the fall. Grow the potted seedlings under cool, sunny conditions. Take indoors as frost approaches. Grow singly in pots and shift only as necessary. Too large a pot may hinder flowering.

When the young plants are several inches tall, pinch out the tips to promote branching. Turn at regular intervals so that well-shaped plants develop. Feed with soluble complete fertilizer at 2-week intervals. Watch soil moisture carefully, and provide for good drainage.

SPRING BULBS (HARDY TYPES)

Of the hardy spring-flowering bulbs that can be forced in pots, tulips, hyacinths, and narcissus (including the so-called daffodils) are most popular as holiday gift plants. Other bulbs sometimes forced for sale are crocuses, grape hyacinths, and squills. Purchase plants with many buds, some just beginning to open, for maximum enjoyment. Hold in a bright but cool location, with night temperatures around 60° F. Keep the soil moist but not constantly soggy, and do not fertilize.

Never attempt to reforce bloomed-out bulbs. It is probably best to discard them. When planted outside in the garden, some may flower the following spring but most of them will not for another year.

If you wish to set out forced bulbs, follow these simple directions. Cut off the stems when flowers are gone, but continue watering. Always leave all the foliage on. Keep in full sun and give a soluble complete fertilizer every 3 to 4 weeks. In late spring, gradually cut down on watering and stop feeding as the foliage begins to mature (yellow) naturally. When dried off, remove bulbs from the soil and store in dry peatmoss in a cool, dry basement room. Plant out in a sunny, adequately drained bed in early fall.

Bulbs such as paper-white narcissus and hyacinths that have been forced into bloom in pebbles and water should be discarded. They are completely exhausted. Furthermore, the paper-whites are not hardy in most areas.

It is great fun forcing your own spring bulbs, and you can do it with reasonable chance of success. For this purpose, buy fresh plump, top-size bulbs.

Local Adaption --- Plant Science

Alfalfa Production
and
Hay Quality Testing

There are three Plant Science units provided in this guide:

1. Home Vegetable Production
2. Horticulture
3. Alfalfa Production and Hay Quality Testing

These units are provided to allow the instructor maximum flexibility in plant science instruction. It is suggested that the instructor and the local advisory committee select the plant science unit which best fits the local community and student needs in plant science.

Alfalfa Production and Hay Quality Testing

OBJECTIVES

Upon completion of this unit, the student will be able to:

1. Select certified alfalfa seed.
2. Understand planting procedures in establishing an alfalfa stand.
3. Suggest a correct fertilization program for alfalfa production.
4. Correctly manage an alfalfa stand.
5. Understand the benefits of alfalfa silage, especially in Western Oregon.
6. Understand why forage quality is important to livestock production.
7. Know what to look for in evaluating hay.
8. Select high quality hay.

References

1. Growing Alfalfa in Western Oregon, EC 806, OSU Extension Service.
2. Alfalfa Silage, EC 1054, OSU Extension Service.
3. Forage Quality: What It Is and Why It Is Important, EC 943, OSU Extension Service.
4. Forage Quality: What to Look for in Evaluating Hay, EC 942, OSU Extension Service.
5. Alfalfa Hay: Quality and Testing, EC 1034, OSU Extension Service.

Instructor Activities

1. A teaching outline is provided based on the Extension Circulars listed as references to this unit.
2. It is suggested that appropriate agricultural mechanics skills might be taught with this information (ie. tillage, seed bed preparation, and planting).
3. If the above mentioned agricultural mechanics skills are taught, use FMO materials for instruction (ie. Tillage Equipment and Planting).

Source:

Hobar Publications
1234 Tiller Lane
St. Paul, MN. 55112

4. Set-up a hay judging contest at the end of the unit so students may test their knowledge of hay quality.
5. Use experiments from Home Garden unit to teach biological principles of crop production.
6. Start plants for experiments early in the unit (use alfalfa seed).

Student Activities

1. Participate in discussions and demonstrations.
2. Apply scientific information (plant growth requirements) to crop production.
3. Start alfalfa seed to use in experiments (use experiments in Home Garden unit).
4. Judge hay quality.

Alfalfa Production

Alfalfa is the most important forage legume in Oregon. When properly harvested, Oregon alfalfa finds ready markets for local livestock use. It produces large yields of high-quality forage and has a long life when grown under conditions to which it is adapted. Alfalfa grows well on deep, well-drained soils with adequate natural moisture. In some areas it must be irrigated. Its forage is an excellent source of protein, minerals, and vitamins for all classes of livestock and can be utilized as hay, silage, or pasture.

Plant Description

Alfalfa, *Medicago sativa* and *Medicago media*, is a hardy, deep-rooted perennial. Rhizobia, members of a group of bacteria which grow in nodules on the alfalfa roots, are able to fix atmospheric nitrogen in a form available for plant use. This process may make available 200 pounds or more of nitrogen per acre each year for plant growth. The large single taproot may reach a depth of 25 feet in well-drained soil. Alfalfa is thus able to withstand periods of drought by utilization of subsoil moisture. Numerous erect stems arise from buds on the woody crown when older growth is removed by harvesting or as it matures.

Varieties

A large number of alfalfa varieties are available in commercial seed channels. Most alfalfa varieties grown in Oregon belong to two groups:

1. Variegated. These alfalfa are generally quite tolerant and produce long-lived stands. Grimm, Ranger, Ladak, Vernal, Atlantic, and Narragansett have been the most popular varieties of this group in Oregon. This group represents the majority of the Oregon alfalfa acreage outside the Willamette Valley.
2. Flemish. Most of the recent Oregon plantings have been of the Flemish type. Varieties of this group have been developed from Western European stock. They are noted for early spring growth and quick recovery after cutting which well suit them to the seasonal rainfall patterns. They are sufficiently winter hardy for western Oregon conditions. Alfa, Apex, Cardinal, DuPuits, Flandria, Pat 30, Resistador, and Thor are varieties typical of this group which is suited for Willamette Valley conditions. New varieties

are becoming available each year.

Bacterial wilt has been identified in western Oregon. Resistant varieties should be used where this disease is present.

Certification of Varietal Purity

Once a specific variety with the desired characteristics has been chosen, the best assurance of varietal purity is to buy certified seed. The certified tag is issued only to seed that has passed rigid field standards designed to protect genetic purity and also has met minimum standards of seed purity and germination after processing.

Seedling Establishment

Alfalfa requires a deep, permeable soil with an adequate moisture supply during the growing season for maximum yields. It is very sensitive to poor drainage and compacted soil conditions which restrict root growth. Thus, alfalfa is most productive on loam or loamy soils that are both well drained and have good moisture-holding capacity. Alfalfa does not tolerate acid soils, especially in the seedling stage. Lime applications well in advance of seeding are required on soils having a pH below 6.0.

Seedbed Preparation

A good seedbed for alfalfa is finely pulverized, leveled, and firmed to the seedling depth with soil moisture near the surface to initiate germination.

Leveling the field to eliminate dead furrows and low spots will result in a more uniform stand and ease equipment travel for the life of the stand.

Methods used to obtain the desired seedbed will vary with soil type and preceding crop. Fall plowing to prepare for spring planting is used where erosion is not a problem. This reduces winter weed growth and permits ample time for spring seedbed preparation. Lime can be spread in the fall and incorporated. This allows time for soil reaction to take place and avoids delays in the spring.

Fertilization

A productive alfalfa crop is a heavy user of plant nutrients. A complete fertilizer program is essential to a long-lived stand. A soil test is the first step in planning a fertility program. Applications of fertilizer and lime, in Western Oregon, should be based on the results of a soil test.

Phosphorus can be applied most effectively by banding $\frac{1}{2}$ to 1 inch to the side or below the seed when seeding or by shallow incorporation just prior to seeding.

Lime should be applied and thoroughly mixed with the surface 6 inches of soil. Fall applications provide time for soil reaction to take place and avoid the spring

rush which will often delay planting.

Time of Seeding

The proper time of seeding alfalfa is determined by seasonal temperature and moisture conditions. Most Willamette Valley seedings are made during May or early June (April in southwestern Oregon) in time to allow good root systems to form before high temperature and low moisture conditions slow growth rates.

Late summer and fall seedings must be made early and have sufficient soil moisture to allow for enough growth to minimize loss of stand from winter injury. Fall seedings without irrigation to assure establishment by September 15 risk being winter-killed.

Inoculation

The presence of effective nodules on the roots of the plants is essential to a vigorous, productive stand. These nodules are formed by bacteria known as *Rhizobium meliloti* that are able to fix nitrogen from the air for use by the alfalfa plants. These bacteria may be present in fields that have grown alfalfa recently, but all strains of bacteria are not equally effective. All alfalfa seed should be inoculated with a fresh commercial inoculum immediately prior to seeding, regardless of cropping history of the land or any previous inoculation of the seed. Inoculated seed should be kept cool and moist until being seeded.

Rate of Seeding

Twelve pounds of seed per acre is sufficient for a good stand of alfalfa. Higher seeding rates are sometimes used to compensate for poor soil preparation or seeding methods. A seeding rate of 12 pounds per acre planted in 6-inch rows will provide 30 seeds per linear foot of drill row or 60 seeds per square foot if broadcast seeded. This is more than adequate to establish a good stand.

Depth of Seeding

Alfalfa seed must be placed in contact with moist soil. Seedlings are unable to emerge from the soil if planted too deep. For best seedling survival, seeds should be drilled approximately $\frac{1}{4}$ inch deep. Seedlings will not emerge from depth greater than $\frac{1}{4}$ inch.

Grain drills equipped with legume-seeding attachments and band fertilizer placement can be set for proper seed placement and provide for banding fertilizer near the seed. Seeding should be followed by cultipacking to firm the soil and place the seed in intimate soil contact. Severe surface compaction that might cause soil crusting after rains or an irrigation should be avoided.

Use of a Companion Crop

Alfalfa seedlings are poor competitors and require favorable conditions for survival and establishment. A

companion crop should not be used except in areas where wind erosion is a problem. The nurse crop will tend to shade out the alfalfa and compete with it for moisture.

Alfalfa-Grass Mixtures

Alfalfa for hay production is usually seeded alone. The decision to seed grass with alfalfa for forage use must be made on an individual basis. There are several advantages in seeding an adapted grass with alfalfa:

- An alfalfa-grass mixture may produce higher quality silage than alfalfa alone.
- A vigorous alfalfa-grass mixture may discourage encroachment of weedy grasses as the stand ages.
- Alfalfa-grass mixtures may be less likely to cause bloat in livestock grazing the stand.

Disadvantages of planting grass with alfalfa include:

- Grass seedlings compete severely with alfalfa seedlings for moisture, nutrients, and light.
- The presence of grass in the hay may lower its marketability.

Alfalfa-grass mixtures in western Oregon will tend to yield more on the first and second cuttings than alfalfa grown alone, while producing less later in the season. This seasonal shift in production may be advantageous when the early cuts can be harvested as silage.

Weed Control During Establishment

Selective herbicides can be used on alfalfa seedlings in pre-emergence or post-emergence applications for control of annual weeds. EPTC or benefin can be incorporated during seedbed preparation to control perennial grasses or in fields where grassy weeds are likely to be problems. It should not be used when an alfalfa-grass mixture is to be seeded.

Annual broadleaf weeds can be controlled selectively with 2,4-DB or dinitro amine applied after alfalfa has two or more true leaves and before the weeds have three true leaves. To obtain the current recommendations and forage tolerances of herbicides, consult your county extension agent or the most recent edition of the Oregon Weed Control Handbook.

Annual weed competition is often controlled during the seedling year by clipping.

Management of an Established Stand

Fertilization

The fertility requirements of a productive alfalfa stand

are quite high because large quantities of nutrients are removed with the crop. The fertility status of the soils must be considered in planning a fertilizer program; thus, all applications should be based on a soil test. Where soil tests indicate moderate or low soil fertility levels, annual fertilizer applications are the key to a productive stand with a long life.

Experiments have shown that alfalfa will economically respond to applications of phosphorus, potassium, sulfur, boron, and lime. The need for these elements will vary with the soil and cropping history. The need for nutrients other than sulfur can be determined with a soil test.

Timing of application, rates, and specific information for western Oregon conditions is given in OSU Fertilizer Guide #18.

Weed Control

Certain weedy annual grasses and broadleaves can be selectively controlled with diuron (karmex), simazine (Princep), propham (IPC), or chlorpropham (CIPC) without serious crop injury if applied when the alfalfa is dormant. Annual broadleaf weeds can be controlled with 2,4-DB or dinitro amine by application before the weeds have more than three true leaves. Since local conditions influence the safety and time of application of these herbicides, consult local authorities or the Oregon Weed Control Handbook.

Cultivation with a springtooth or harrow has been used in the past to control annual weeds in alfalfa. This practice, however, injures alfalfa crowns, opening them to attack by disease organisms, and weakens the stand. It is not recommended.

Maintaining Plant Vigor

The timing of the removal of top growth of alfalfa by mowing or grazing may have a profound influence on the productivity and length of life of an alfalfa stand. The large taproot of the alfalfa plant is a storage organ for food reserves needed to renew top growth in the spring and after each cutting. The maintenance of food reserves is necessary to keep the stand vigorous and productive. Food reserves in alfalfa roots have been shown to increase as the interval between cuttings is increased to 35 days, after which it declines. Cutting more frequently than 28 days or continuous grazing will lower the root reserve and weaken the stand.

Rodent Control

Gopher, mole, and field mice populations build up in perennial stands of alfalfa because of ample feed supplies and protection of nesting sites. Left uncontrolled, these rodents will lower alfalfa productivity and shorten the life of the stand.

Prevention of population invasions during the seeding year is most desirable. Relative effectiveness of trapping, baiting, and poisoning varies with location and skill of the operator. Detailed recommendations for control of these rodents are given in Extension Bulletin 804, "Mole and Gopher Control."

Encouragement of the natural predators--owls, hawks, fox, and skunks--will also be helpful.

Pasturing Alfalfa

Early season grazing often provides a method of utilizing early alfalfa growth that could not be successively made into hay because of frequent rains. The soil must be dry enough to avoid damage to the stand from trampling.

Continuous close grazing will damage the stand and result in thinning or winter kill. If alfalfa is to be used primarily for pasture, a system of rotational grazing must be provided which allows for a regrowth period of 30 to 35 days to allow for re-establishment of root reserves. If continuous grazing is allowed, the grazing intensity must be adjusted to allow a plant height of three to six inches and the plants must never be completely defoliated. In the fall, the growth must be allowed to reach 8 to 12 inches and remain until the tops are frozen back.

Grazing may be a profitable way of utilizing regrowth following the last alfalfa cutting of the season. Regrowth must be allowed to build root reserves to reduce winter injury; however, this top growth may be removed after the first killing frost without affecting root reserves.

Bloat

When alfalfa is grazed, caution must always be exercised to prevent livestock losses to bloat. Hungry cattle should never be turned on new alfalfa growth. Feeding grass hay or straw before turning livestock on alfalfa may be of value in reducing excessive intake. Allowing stock to graze only a short time each day until they become accustomed to alfalfa pasture is also recommended. Bloat preventative materials are available which can be fed as a feed additive or in salt block.

Alfalfa Silage

Although alfalfa is traditionally made into hay, weather conditions at the time of first cutting do not always cooperate with haying operations. Alternate methods of maintaining the feed quality of alfalfa include making silage or green chop. Alfalfa silage provides an opportunity to maintain the feed value without curing to 18 percent moisture for hay.

Feeding Value

Alfalfa silage is higher in crude protein (CP), calcium (CA), and phosphorus (P), but lower in total digestible nutrients (TDN) than some other silage materials (Table 1). Rations including alfalfa silage as a substitute for corn silage should be adjusted accordingly.

Table 1. Composition of Various Silages

Type of silage	Percent of the dry matter			
	CP	TDN	CA	P
Alfalfa	17.1	57.0	1.64	0.26
Corn	8.9	68.5	0.33	0.21
Oats	10.5	55.0	0.26	0.24
Grain sorghum	8.5	65.2	0.28	0.23
Forage sorghum	9.2	57.9	0.30	0.24

Fermentation and pH

The principles of making alfalfa silage are the same as those for corn or other silage. Corn has a high concentration of readily fermentable carbohydrates, however, which makes the ensilage process possible without added carbohydrate. Alfalfa, a high protein feed, requires supplemental carbohydrate for proper fermentation.

When alfalfa is harvested (tops cut), the forage continues to respire actively for some time. In this process, plant enzymes and aerobic bacteria (those that require oxygen) use the readily available carbohydrates to produce heat and carbon dioxide (CO_2), which decreases the available supply. Supplemental carbohydrates are necessary to enable aerobic bacteria to produce lactic, acetic, and propionic acids, which preserve the forage as silage. These organic acids preserve the plant material by reducing the pH to 4.2 or below. This low pH inhibits further bacterial growth and enzyme action. This process takes about 2 to 3 weeks.

The most critical time in silage making is during the first few hours of storage. Long exposure of the forage to air may result in the disappearance of much of the readily available carbohydrate. This may prevent the production of an adequate amount of lactic acid and result in a high pH conducive to deterioration of the plant material. Undesirable bacteria, belonging to the genus *Clostridium*, grow under high pH and result in butyric acid, ammonia, and various amines associated with poor silage quality.

Water content

To reduce seepage from the silo and production of poor quality silage, permit alfalfa that is cut for silage to wilt in the swath or windrow until the moisture

content reaches approximately 65 percent. The proper moisture content can be determined by a grab test. Squeeze or wring out the moisture in a handful of the forage and examine the ball. The forage ball should fall apart slowly, with with no free juice apparent (see Table 2).

Low-moisture silage can be made from crops wilted to a moisture content between 40 to 60 percent. This type of silage is stored either in air-tight or conventional tower silos. Assure air exclusion by filling the silo or bunker rapidly with fine-chopped forage and providing a good seal, as low-moisture silages have limited bacterial growth and fermentation. The most important consideration is the presence and maintenance of air-free conditions. Silages may be subject to spontaneous heating if they have less than 40 percent moisture or if oxygen is available. Spontaneous heating can produce fires or lower the quality of silage by caramelizing carbohydrates and reducing protein digestibility.

Table 2. Determining Forage Moisture Content by the Grab Test

Condition of forage ball	Approximate moisture content
	Percent
Holds shape, considerable juice.....	Over 75
Holds shape, very little juice	70 - 75
Falls apart slowly, no free juice	60 - 70
Falls apart rapidly	Below 60

Additives

Feed additives or chemical preservatives are necessary when ensiling alfalfa containing more than 65 percent moisture. Use grains or feeds such as ground corn, barley, wheat, oats, or molasses to provide readily available carbohydrate for fermentation. Mineral acids such as formic, propionic, or lactic acid can be used as an alternative way to reduce the pH. The addition of sodium metabisulfite also has been used to prevent the growth of undesirable bacteria. This bacteriostat has been used less in recent years, however, because it reduces palatability of the silage. The quantity of feed additives and mineral acids needed to preserve alfalfa silage are listed in Table 3.

Table 3. Additives Useful in Making High-Moisture (65%) Alfalfa Silage.

Additive	Quantity required
	Pounds per ton
Feed grains (ground corn, barley, wheat, oats).....	100 to 200
Chopped hay, beet pulp, or ground corn cobs	200
Molasses.....	40 to 80
Formic, propionic, or lactic acid.....	20 to 40
Sodium metabisulfite	8

Process of making silage

The following steps are involved in making high quality alfalfa silage:

1. Swath, condition, and windrow (at least bud or early bloom state of maturity).
2. Allow to dry to 60 to 70 percent moisture.
3. Chop forage from 2 to 5 inches in length.
4. Add readily available carbohydrate or preservative to high-moisture silage.
5. Fill silo or bunker rapidly and pack thoroughly.
6. Use a suitable seal to exclude air (black plastic on bunker or pit silo).
7. Leave silo undisturbed until ready to use silage.

Following these steps will result in preserving a high quality feed at a time when waiting for hay-making weather conditions could cause a loss of this forage or severely reduced quality due to spoilage.

Making Alfalfa Hay

Most of the alfalfa grown in western Oregon is harvested as hay. The procedures used vary with the locality and the season; however, several general principles apply.

Timing of Cutting

Cutting at the proper stage of growth can have a greater influence on hay quality, total production, and life of the stand than any other management decision. The highest quality hay is that cut in the early bud stage when the plants have a high proportion of leaves that

are rich in protein. As the plants mature, the stems become coarser and constitute a larger proportion of the total plant. As the plant matures, protein percentage decreases and fiber content increases. However, alfalfa cut at the pre-bud state produces less forage per acre and continued early cutting seriously weakens the stand.

The bloom is often delayed by cool weather in the spring in western Oregon and is not the best indication of cutting time. The appearance of new bud growth at the crown, near the soil surface, or the yellowing of lower leaves, is the indication of time to make the first cutting. This stage of growth is most often reached in early May. Later cuttings may be made at the late bud or early bloom stage of growth.

Curing

New mown hay contains 70 to 80 percent moisture, depending upon atmospheric conditions. Well-cured hay contains 15 to 20 percent moisture. The objective of the curing step is to provide conditions for the removal of this moisture as rapidly as possible while preserving the green color and preventing leaf shatter. Overdrying with associated leaf loss during handling is one of the most common causes of loss in hay quality. Raking should be done before the leaves dry or during periods of high humidity such as the night or early morning to reduce leaf loss.

Mechanical devices which crush or crimp the alfalfa stem may be helpful in speeding the curing process, thus reducing the time that the hay is exposed to the risk of rain. This is particularly important for the first cutting under western Oregon conditions.

Forage Quality

WHAT IT IS AND WHY IT IS IMPORTANT

Forage crops are those grown primarily for livestock feed and harvested to be fed later, or harvested directly by grazing animals. Included are all plants grazed by animals or harvested for hay or silage.

Since forages are consumed by animals, the product fed must be acceptable to the animal. Forages are marketed primarily in the form of animal products, that is, meat, milk, or wool, so the animal must be considered in the development of a sound forage feeding program. A high quality forage has a high feeding value per unit and is also more readily consumed.

What is forage quality?

The term quality, as applied to forages, generally means the same as feeding value and may be defined as the ability of a forage to supply animal nutrient requirements for a specific production function (meat, milk, or wool.) The equation for quality may be written:

Available nutrients
 Quality = per unit of forage X Rate of intake

The value of forage for the production of meat, milk, or wool, therefore, depends on the availability of the nutrients consumed and the quantity of forages voluntarily consumed. When the daily intake of forage, the chemical composition, and the digestibility are known, the daily intake of nutrients can be calculated.

Meeting animal requirements

A simple approach to the determination of the energy needs of an animal--or the need for any nutrient--is:

$$\begin{array}{rcl} \text{Energy to be} & & \text{Energy required} \\ \text{supplied by ration} & = & \text{by animal} \\ \text{Energy for} & + & \text{Energy for} \\ \text{maintenance} & & \text{production} \end{array}$$

For example, using this approach and standards established through the years, a dairy cow weighing 1,000 pounds and producing 60 pounds of 4 percent fat corrected milk would need approximately 27.2 pounds of total digestible nutrients (TDN) daily to meet the requirements for production and maintenance (Figure 1). This represents the energy contained in 36.2 pounds of grain or 49.4 pounds of average hay. Most 1,000-pound cows cannot eat 49 pounds of hay. The hay intake is not likely to exceed about 30 to 35 pounds. As shown in Figure 1, the energy supplied from forages decreases as the quality decreases; consequently, the energy supplied from grain must be increased if production levels are to be maintained.

Although the TDN requirements are different for dairy cattle, beef cattle, sheep, and horses, the principle shown in Figure 1 is the same for all types of livestock.

The effect of forage quality on forage dry matter intake, dry matter digestibility, and the milk potential of the forage is presented in Figure 2. As forage quality decreases, forage intake and nutrients supplied by the forage also decrease, and the milk production potential will approach zero, as is indicated for poor quality forage in Figure 2.

Considering the poor quality of the forage used on many farms, it becomes evident why dairy producers and beef cattle feeders depend heavily on grain to produce milk and meat. On most farms, a material saving in the cost of producing livestock and livestock products could be made by feeding more high quality hay and less grain per animal unit. If the fullest use is to be made of an animal's capacity for utilizing forage, this forage should be palatable and nutritious, for a ton of high quality forage supplies more digestible nutrients than a ton of low quality forage of the same kind. An animal's appetite may be satisfied with low quality forage before it gets enough nutrients from the forage portion of the ration to ful-

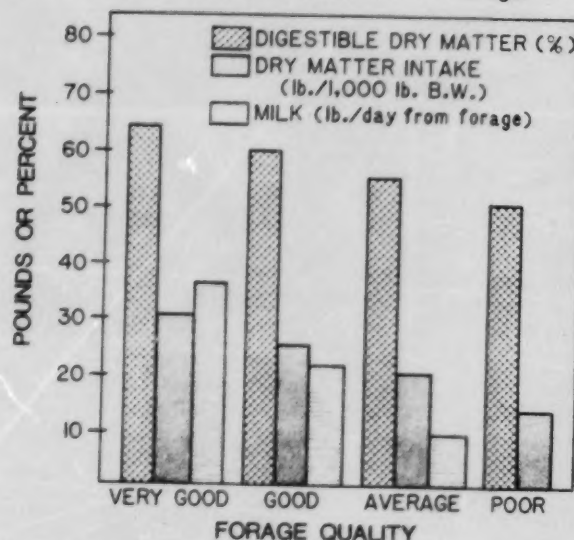
fill its requirements.

Figure 1. Forage quality and grain required (1,000-pound cow producing 60 pound 4 percent fat corrected milk).

REQUIRED	MAINTENANCE	MILK	GRAIN NEEDED (lb)
	8.0 lb. TDN	19.2 lb. TDN	
SUPPLIED BY FORAGE	FORAGE	DEFICIT	
	19.5 lb. TDN	7.7 lb. TDN	
VERY GOOD			10.3
GOOD	FORAGE	DEFICIT	
	15.0 lb. TDN	12.2 lb. TDN	
			16.5
AVERAGE	FORAGE	DEFICIT	
	11.0 lb. TDN	16.2 lb. TDN	
			22.0
POOR	FORAGE	DEFICIT	
	7.5 lb. TDN	19.7 lb. TDN	
			26.2

Source: Adapted from Forage to the Front, Ag. Ammonia News, May-June, 1964.

Figure 2. Effect of forage quality on digestibility, dry matter intake, and milk production from forage.



Source: Adapted from Forage to the Front, Ag. Ammonia News, May-June, 1964.

Determining the quality of forage

There are two principal methods that you can use to determine forage quality. One is to sample the hay and/or silage to be fed and have it chemically analyzed. This analysis can be obtained from the Forage Analytical Service at Oregon State University or at any of a number commercial laboratories in Oregon and surrounding states. Your county Extension agent has sampling instructions as well as the appropriate forms to be used when submitting samples to the OSU Forage Analytical Service. Your Extension agent can also help you locate other testing laboratories, and is available for assistance in interpretation of the analysis and in planning more efficient rations.

The second method is visual and one you can do on the farm. It requires judgment based on certain physical characteristics of the forage.

How do we estimate forage quality visually?

Visual estimates of forage quality are based on factors known to influence hay and silage quality, and animal performance. These factors are stage of maturity, leafiness, color, foreign material, and the odor and condition. Let's examine each one of these factors in some detail.

Stage of maturity. This refers to the growth stage of a plant at the time it is harvested. This is an important factor in determining the maximum feed value obtainable from an acre of forage. Early cut hay is high in feed value. For example, more than twice as many pounds

of alfalfa hay cut in the seed stage is required to produce 100 pounds of gain in steers than alfalfa cut in the bud stage (Figure 3). This is because animals eat less of the poorer quality hay per day and will take longer to gain weight.

Total digestible nutrients (TDN), which includes protein, are higher in early cut hay (Figure 4) as are phosphorus and carotene (the compound from which vitamin A is formed). Note in Figure 4 that alfalfa in the bud stage may have in excess of 20 percent crude protein while at full bloom the protein content may only be 10 to 12 percent. Alfalfa hay cut at the late bud to very early bloom stage has a potential as high as 65 percent digestible nutrients (Figure 5). The same crop cut at full bloom usually has dropped to 55 percent digestible or less. Thus, late cut hay is low in feed nutrients.

Comparable figures for grasses are 65 percent TDN and 12 to 15 percent crude protein at the boot stage (head emerging from the leaf roll) and 50 percent or less TDN and 4 to 8 percent crude protein when the bloom is on the grass heads. There is less protein in a hundred pounds of either grass or legume as maturity advances (as the crop becomes older).

The time of cutting also makes a great difference in the palatability of hay or silage. As with digestibility, palatability also decreases as the crop becomes older (Figure 5). This is largely a result of the increasing amounts of fiber found in plants as the crop matures. Figure 6 shows that the average percent crude fiber of alfalfa in the bud stage is 20 percent, while at full bloom the percentage has increased to 35.

A common fault in forage harvest is to delay cutting too long. The quality of many excellent crops of grasses, alfalfa, and red clover is virtually sacrificed because they are not cut early enough. It is impossible to make high quality hay or silage from late-cut grass, alfalfa, and red clover, even with perfect curing weather.

The loss in quality with delayed cutting is not as serious with trefoils (lotus), white clover, and subterranean clover since their quality does not decline as rapidly with advancing maturity as happens with alfalfa, red clover, and the grasses. Trefoils and white and subterranean clovers do not drop the lower leaves as maturity advances, and their stems are finer and softer; thus they do not become as stemmy and unpalatable with maturity.

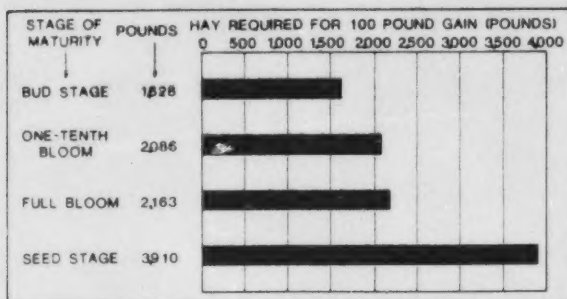
On a yearly basis, early-cut hay yields as much feed (digestible dry matter) per acre as later-cut hay and provides better livestock performance. Early-cut hays make desirable feed because they contain more digestible material. And because early-cut hays are more palatable, they are eaten in larger quantities by livestock and require less supplementation with grain than later-cut hays.

Leafiness. The amount of leaves in relation to stems is a more critical factor with legumes than with grasses because leaf loss during curing and handling is much greater with legumes. Leaves are higher in overall feed value than stems, as indicated by higher TDN, protein, and carotene contents, and a lower fiber content. On the average, alfalfa leaves contain about 24 percent crude protein and 14 percent crude fiber while the stems contain only 10 to 11 percent crude protein and 38 percent crude fiber. In other words, the leaves of alfalfa have about 2½ times as much protein as the stems and are very important in determining feed value. The protein in the leaves is also more digestible than that in the stems.

Since leaves are high in protein and low in fiber, highest quality hay is cut in the bud to early bloom stage when plants have a high proportion of leaves. As the plants mature the stems become larger, lower leaves fall from the plant, and the proportion of leaves decreases (Figure 4), resulting in a decline in protein and an increase in fiber.

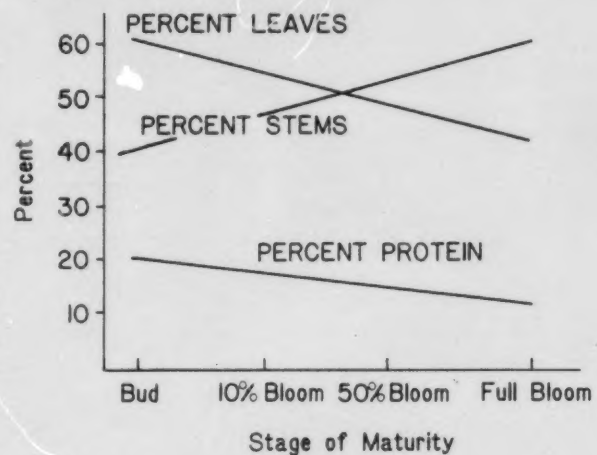
The amount of leaves is an important indicator of both feed value and yield in hay.

Figure 3. Gains in weight of steers affected by the maturity of the alfalfa fed.



Source: Hay Quality: Relation to Production and Feed Value. USDA Miscellaneous Publication No. 363.

Figure 4. Effect of stage of maturity on average percent leaves, stems, and alfalfa protein.



Color. This indicator is associated with the nutrient content, especially carotene. Color also indicates how well the hay is cured. The most desirable color approaches that of the bright green, immature crop in the field. This is usually associated with early cutting, good curing, pleasant aroma (odor), high palatability, freedom from must or mold, and a relatively high carotene content.

Any change in color indicates a reason for loss in feed value:

- Yellowing usually indicates more mature hays.
- A light golden yellow or bleached appearance may be a result of bleaching by the sun or it may indicate that rain has leached (washed) out some of the most digestible nutrients.

- Brown indicates heating caused by storage of high moisture hay. Brown hay usually has a distinctive odor and the baled hay is usually caked.
- Blackening indicates excessive rain damage --spoilage of plant tissues after curring.

Brown or black hay is an indicator of considerable losses in dry matter, vitamins, and digestibility (especially digestibility of protein). The presence of the dull gray of mildews and molds indicates that the hay was stored at too high a moisture content. Such hay has also lost dry matter and quality.

Foreign material. Hay can contain non-injurious and injurious material. Non-injurious foreign material describes all kinds of matter that is commonly wasted in feeding operations, but that is not harmful to livestock if eaten. This includes weeds, so-called viregrasses, over-ripe grain hay, grain straw, cornstalks, stubble, chaff, sticks, certain grasses if mature, and any other objectionable matter that might occur in the hay. Some of the grasses if mature, and any other objectionable matter that might occur in the hay. Some of the grasses that are considered as foreign material when mature are wild rye, most annual brome-grasses such as cheat and chess, pigeon grass (sometimes called foxtail or wild millet), broomsedge, and needle-grasses from which the needles have fallen.

Material that will cause injury or that is poisonous when eaten by livestock is considered injurious foreign material. This includes sandburs, poisonous plants such as tansy ragwort, harsh or rough bearded grasses like mature foxtail, wild barley, 3-awn grass, or ripgut brome, and grasses that have a sharp point at the base of the seed (matured needle grasses with the needles attached). It also includes any other matter such as wire or nails.

Hay containing weeds or other foreign material is discriminated against on the market because weeds represent waste and give the hay a bad appearance. Weeds are objectionable for feeding purposes because the weed seeds usually pass through the animal undigested and when the manure is spread on the land, it becomes a source of weed infestation. Many noxious weeds are spread in this way.

Odor and condition. The aroma of new mown hay is the standard with which all odor comparisons should be made. Any other odor, such as mildewy, musty, or putrified (rotten), indicates lowered quality. Storage at too high moisture, or weather damage cause odor problems and result in lowered acceptability to livestock.

Attention should also be given to the condition of the hay. It should be free from must and mold, as well as free from insect and disease damage. It also should not be dusty.

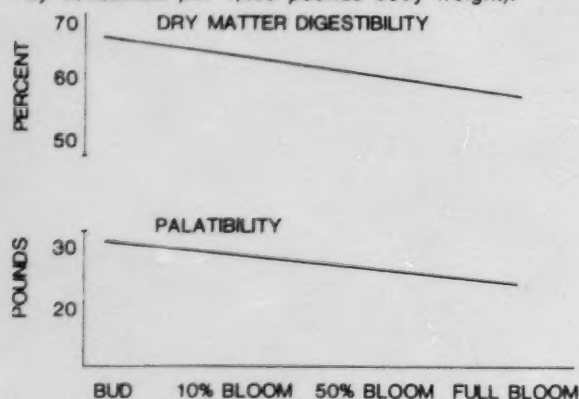
Combining chemical and visual analyses

A visual evaluation supported by chemical analysis is

the most reliable indication of quality. Chemical analysis gives a reliable measure of the items determined, but a visual examination reveals quality factors such as spoilage, foreign material, and leaf shattering or loss. Chemical estimates do not show these factors.

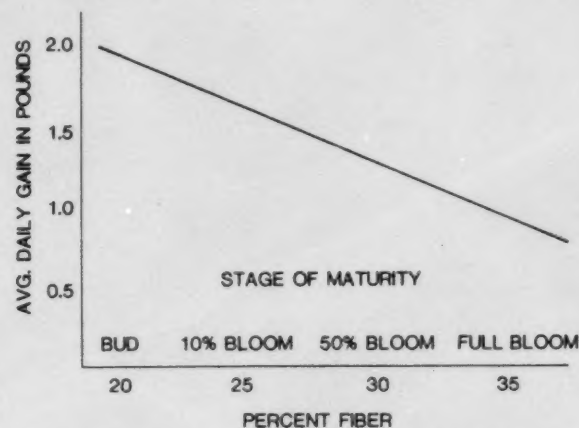
Visual examination alone, while being very useful, creates problems for livestock producers, particularly those who purchase their forage requirements and desire a consistently high quality product. For example, a sampling of 5 lots of hay that appeared to be almost identical showed a wide range of quality as determined by chemical analysis. The percent crude protein in these lots was 19.7, 17.7, 15.3, 11.7, and 13.7. Whenever possible, chemical analysis should be combined with visual estimation.

Figure 5. Effect of stage of maturity of alfalfa on average dry matter digestibility and palatability (pounds of hay consumed per 1,000 pounds body weight).



Source: Management of Irrigated Forages in Nevada. Nev. Agr. Exp. Sta. Bull. B29.

Figure 6. Effect of maturity stage of alfalfa on average percent crude fiber and estimated daily gains of a 500-pound calf on full feed.



Source: Management of Irrigated Forages in Nevada. Nev. Agr. Exp. Sta. Bull. B29.

Summary

Forage quality generally means feed value and is dependent upon the availability of nutrients (chemical composition) and the amount of forage consumed (rate of intake). A number of factors are known to influence forage quality and animal performance, the most important of which is stage of maturity. Top quality forages are cut early. Alfalfa should be cut in the late-bud to early-bloom stage; clovers, 25 to 50 percent bloom; and grasses, in the boot to early heading stage. Treat alfalfa-grass mixtures as alfalfa, and clover-grass mixtures as grass. Top quality forages are also leafy, bright green in color, and free from weeds, mold, or mustiness. They are high in protein, energy, digestibility, carotene, and minerals, and low in fiber.

Forage varies more in quality than any other harvested feed crop grown on American farms. There is a wide variation in forage quality, even within a single species grown in almost identical conditions. This variation is due largely to a lack of understanding of the fundamentals of good haymaking and to a tendency among farmers to give less attention to their hay crop than to their livestock or to crops such as wheat and potatoes.

Characteristics of high quality forage have been emphasized throughout this discussion; however, this does not mean that all livestock should be fed only the highest quality forage. A substantial portion of the ration for maintenance of dry beef and dairy cows, dry ewes, and mature horses can consist of low and medium quality forages. These animals can make the best use of lower quality forages. Young, growing animals and high-producing milk cows have higher nutrient requirements and should receive the higher quality forage.

Knowing the nutrient requirements of the livestock to be fed and the nutrient contents of the forage available for feeding, the livestock producer can formulate balanced rations using combinations of forages with varying quality levels or combinations of forages and protein and/or energy supplements. Low quality hay can often be supplemented with several pounds of high quality hay, saving the cost of concentrate feeds. Hay buyers will frequently find both excellent and poor quality hays are offered at the same price. Knowing the higher quality feed can also save you money.

The quality of forage fed to livestock determines how far you can cut expensive concentrates to minimize costs and maximize profits. Livestock feeders seeking profits consider good quality forage as the basis of any livestock ration; low quality forage, lacking in essential nutrients, must be supplemented with expensive concentrates. Substantial savings in the cost of producing livestock and livestock products could be made on many farms by feeding more high quality hay and less grain per animal unit.

Forage Quality WHAT TO LOOK FOR IN EVALUATING HAY

Evaluating hays can teach you a great deal about factors that affect the feeding value of hays as well as the defects that are likely to appear. Top quality hay is associated with high protein and high total digestible nutrients (TDN) contents. The quality of forage fed to livestock determines how far you can cut expensive concentrates to minimize costs and maximize profits. Livestock feeders seeking high profits consider good quality forage the basis of any livestock ration because essential nutrients not supplied by the forage must be supplemented by expensive concentrates.

Hay varies more in quality than any other harvested feed crop grown on American farms. There is a wide difference in the quality of hay, even within a single species grown in the same locality and under almost identical conditions. This variation is due largely to lack of understanding of the fundamentals of good haymaking and to a tendency among farmers to give less attention to their hay crop than to other cash crops such as wheat and potatoes. Hay buyers will frequently find both excellent and poor quality hays offered at the same price. Substantial savings in the

cost of producing livestock and livestock products could be made on most farms by feeding more high quality hay and less grain per animal unit.

How to evaluate hay quality

Hay should be evaluated for characteristics that will affect its value as feed. Quality in hay really means feed value. The factors known to influence hay quality and animal performance are stage of maturity, leafiness, color, foreign material, and the odor and condition.

Stage of maturity. This refers to the growth stage of a plant at the time that it is harvested. The stage of maturity of legumes and grasses can be easily identified before they are cut, but after the hay is cut and cured it is more difficult. Weathering or sun-bleaching of the hay or delay of the normal development of the flower parts of legumes because of weather conditions complicates the determination of stage of maturity even more.

The stage of maturity at which alfalfa was cut is determined by observing the condition of the bloom and the texture and woodiness of the stems. Alfalfa cut in the bud stage can be recognized by the size of buds at the tips of the stems and by the absence of the purple flower petals. Bud-stage alfalfa also is usually very leafy and the stems are relatively fine and pliable. Alfalfa cut in the early bloom stages has some purple flowers petals and stems that are larger than in bud-stage alfalfa. Alfalfa hay that is cut after it has blossomed has distinctly larger, woody stems, fewer leaves, and a rather stemmy appearance. Alfalfa cut after the full-bloom stage is usually indicated by the large stems, by the presence of seed pods, and by a deficiency of leaves. Alfalfa blooms profusely under certain conditions and sparingly under others, making determination of the exact stage of maturity by the number of blossoms somewhat difficult.

The stage of maturity of clover can be determined by observing the color and condition of bloom and the maturity of the seeds, if any are present. Clover that was cut no later than the full bloom stage will have numerous heads that show the red or purplish-red blossoms of the red clover, or the pinkish-white or white blossoms of white and subterranean clovers, provided the hay was not weathered while being cured. Clover cut in the full bloom stage will have no seeds, or at most, only a few shrunken ones. A stage between full bloom and full maturity is indicated by the brown color of all the clover heads and the presence of yellowish-brown seeds. Full maturity is indicated by the dark-brown color of the heads and the presence of plump, mature seeds. The first crop of clover often does not produce seed, which will account for the absence of seed in hay that has other appearances of being late-cut. Clovers should be cut at the one-fourth to one-half bloom stage for top quality hay.

The stage of maturity at which grasses were cut for hay

can be determined easily by examining the heads. First-cutting orchardgrass, reed canarygrass, and tall fescue should have been cut in the boot (head is emerging from the leaf roll) to early heading stage. First-cutting timothy, perennial ryegrass, and smooth brome grass should have been cut in the early to medium heading stage. If these grasses were cut before full bloom, no ripe seeds will be present and parts of the flower can be seen. Full maturity is shown by the plump brown seeds that shell out easily from the whitish dry glumes or chaff. The stage of maturity of grasses is also related to green color. Even if not weather damage, grasses with fully ripe seeds usually have yellowish-brown stems and heads and many brown leaves.

Alfalfa-grass mixtures should be cut according to the maturity of the alfalfa; that is, when the alfalfa is in the late-but to early-bloom stage. Clover-grass mixtures should generally be cut according to the maturity of the grass.

Leafiness. The amount of leaves in relation to stems is a more critical factor with legumes than with grasses, because legumes lose their leaves more readily than grasses during curing and handling. Leafiness is extremely important since two-thirds of the protein is found in the leaves.

Leafiness will depend upon the stage of plant maturity. As plants mature, the stems become larger, lower leaves fall from the plant, and the proportion of leaves decreases. Since leaves are high in protein and low in fiber, highest quality hay is that cut in the late-bud to early-bloom stage when plants have a high proportion of leaves.

Leaf shatter during raking and baling is another major cause of reduced quality. This leaf loss is greater as maturity increases. The method of curing, the method of handling the hay from field to storage, and weather conditions during curing and baling also influence leafiness. It must be emphasized that hay must be cut early and carefully cured and handled in order to save leaves.

Leafiness in alfalfa hay, for example, may vary from 65 to 70 percent for very leafy hay, to only 10 or 15 percent for very stemmy hay. A bale of very leafy alfalfa hay has an appearance in which the leaves predominate and cling to the stems. The stems are soft and pliable. Hay that has been so cured and handled that the leaves cling to the stems usually has pliable stems. On the other hand, alfalfa hay which has a low percentage of leaves will appear very stemmy in the bale.

When leaves are off the stems and are loose in the bales, the hay is likely to lose feed value through waste when the bales are opened for feeding.

Color. This is another definite indication of hay feed value. The most desirable color approaches the bright green of the immature crop in the field. This color usually indicates that the hay was cut at an early stage of maturity

and well cured. The fresh aroma (odor), freedom from must or mold, and a relatively high carotene content added to its palatability and feed value.

The bright green color in hay may be lost by bleaching in the sun, rain during curing, fermentation in the bale, stack, or mow, or because the plants were too mature when cut. Sun bleaching reduces the palatability of hay. Rain will leach a large portion of the plant nutrients.

The appearance of bleached hay will tell much about the cutting and handling methods:

- Sun bleached hay has a light golden yellow color and need not be discriminated against as seriously as hay which has been rained on or which has heated in the stack. Only material on the outside of the window or only the sides of the bale exposed to the direct sunlight, will be bleached. The other material should be a bright green.
- Brown colored hay indicates heating and fermentation caused by storage at too high moisture. This hay usually has a distinctive musty odor and the bale is often caked.
- Yellowing, especially in grass hay, usually indicates that the plants were over-mature when cut. This can be distinguished from sun bleaching in that all plants will have the same yellowish color.

Slight discolorations from sun bleach, dew, or moderate fermentation are not as serious as the loss of green color from maturity, rain damage, or excessive fermentation.

Foreign material. These materials can be divided into non-injurious and injurious. Non-injurious foreign material means those kinds of matter in hay that are commonly wasted in feeding operations, but are not harmful to livestock if eaten. This includes weeds, so-called wire grasses, over-ripe grain hay, grain straw, corn stalks, stubble, chaff, sticks, and any other objectionable matter. Some grasses, such as wild rye, most annual brome-grasses such as cheat and chess, pigeon grass (sometimes called foxtail or wild millet), broomsedge, and needlegrasses from which the needles have fallen, are considered as foreign material when mature.

Material that is poisonous or will harm the animal when eaten is considered injurious foreign material. This includes sandburs, poisonous plants such as tansy ragwort, harsh or rough bearded grasses like mature foxtail, wild barley, 3-awn grass, or ripgut brome, and grasses that have a sharp point at the base of the seed such as matured needle-grasses with the needles attached. It also includes any other matter such as wire or nails. Hay containing injurious foreign material should not be purchased. In a judging contest, a sample containing injurious material should be placed

at the bottom of the class.

Weeds are the most common non-injurious foreign material found in hay. They are usually not relished by the livestock and when eaten have little or no feed value. Hay containing weeds or other foreign material is discriminated against on the market because weeds represent waste and give the hay a bad appearance. Weed seeds usually pass through the animal undigested; when the manure is spread on land, it becomes a source of weed infestation.

Odor and condition. The smell of new mown hay is the standard for comparisons. Mildew, mustiness or putrified (rotten) odor indicates lowered quality and are caused from storage at too high moisture or weather damage. Odor problems usually result in lower acceptability by livestock.

Attention should also be given to the condition of the hay. It should be free from must and mold and from insect and disease damage. It also should not be dusty.

Visual evaluation of the hay based upon factors influencing quality.

The sample score sheet below can be used as a guideline for visually evaluating hay. The score sheet indicates the amount of importance to place upon each factor. You will note the stage of maturity is the most important factor, with 30 points being allocated to that factor. Leafiness, color, and odor and condition each receive a possible 20 points, while foreign material has a possible 10 points.

SAMPLE SCORE SHEET

	Possible score	Score given
<u>Stage of maturity</u>		
Alfalfa should be cut in the late bud or early bloom stage, clovers at one-fourth to one-half bloom. Most grasses should be cut in the boot to early heading stage. These stages of maturity score highest (25 to 30 points). Alfalfa and clovers cut at the full bloom stage or grasses cut between the late heading and full bloom stages score low because they have lower feed value (1 to 10 points).	30	
<u>Leafiness</u>		
Hay with a high ratio of leaves to stems and with a high proportion of the leaves attached scores high (15 to 20 points). Stemmy hay and hay with leaves shattered scores low (0 to 5 points).	20	

SAMPLE SCORE SHEET (continued)	Possible score	Score given
<u>Color</u>		
Hay with a bright green color scores high (15 to 20 points). Golden yellow to yellow colored hays score 5 to 15 points. Dark brown or black colored hays score 0 to 5 points.	20	
<u>Foreign material</u>		
Hay with non-injurious foreign material should receive a lower score than that without (0 to 10 points). Hay with injurious foreign material should be disqualified and placed at the bottom of the class with no score.	10	
<u>Odor and condition</u>		
Smell of new mown hay scores high (15 to 20 points). Hays with musty or other off-odors score 5 to 15 points. Moldy or unusually dusty hays are scored very low (0 to 5 points).	20	
TOTAL	100	

Characteristics of excellent, good, fair, and poor quality hays.

Excellent quality. Leguems cut in the late bud to early bloom stage for alfalfa or one-fourth to one-half bloom stage for clovers; grasses cut in the boot stage. Leafy, bright green color and free from mold or mustiness. High in carotene, protein, minerals, and energy; low in fiber.

Good quality. Legumes cut by one-half bloom; grasses cut in the early heading stage. Leafy, good green color and free from mold or mustiness. Hay that is rained on after partly cured can fall into this category if it was cut early. The nutritional value is not as high as excellent quality but good results can be obtained when properly supplemented.

Fair quality. Legumes or grasses cut at full bloom. Lacks green color, stemmy, low in carotene, minerals, protein, and energy. High in fiber.

Poor quality. Any legume or grass cut after full bloom. Severely weather damaged, bleached, stemmy, lacking leaves, musty, or moldy.

Using your hay evaluation skills to determine the hay inventory for your farm.

The physical characteristics previously described should

indicate to you that there is a wide variation in the potential feeding value of hay. You can use your hay evaluation skills to estimate the quality of the hay that you are feeding to your livestock. You may be surprised to learn that the quality of the hay being fed is better than you originally thought, and you can reduce the amount of concentrate feed. On the other hand, you may find that the quality of the hay is poorer than you thought, and you may need to increase the amount of concentrate feed.

The figures in the following table illustrate one way of taking inventory of the forage supply on your farm.

Factors for converting hays of varying quality
into equivalent amounts of good hay

Hay quality	Physical characteristics	Conversion factor
Excellent	Very early cut, leafy, bright green	1.2
Good	Early cut, leafy, green	1.0
Fair	Medium to late cut, without excessive damage or loss of leaves	0.8
Poor	Late cut, coarse, stemmy, unpalatable	0.6

Example: You have 60 tons of fair quality hay, 40 tons of good quality hay, and 20 tons of excellent quality hay. How many tons of hay do you have in equivalents of good quality hay?

$$60 \times 0.8 = 48$$

$$40 \times 1.0 = 40$$

$$20 \times 1.2 = 24$$

Total = 112 tons in terms of potential feeding
values instead of 120 tons

The 120 tons of hay you have represents only 112 tons of hay in terms of its potential feeding value. In actual feeding, animals will eat less of the fair quality hay when compared with good quality, therefore, the lower conversion factor. When fed excellent quality hay, animals may eat more of it. But even if they ate the same amount, the feed nutrients contained in the excellent quality hay will result in better animal production and performance than if the animal is fed lower quality hay.

Summary

Hay quality generally means the same as feed value. Five basic factors are known to influence hay quality and animal performance, the most important of which is stage

of maturity. Top quality hay is cut early, is leafy, has a bright green color, and is free from foreign material, mustiness, or mold.

The importance of developing skills in evaluating hay quality is not to win a judging contest, but rather to be a wise livestock feeder. Remember that the quality of the hay fed to your livestock determines how far you can cut down on the feeding of expensive concentrates and thus boost your profits. If you buy hay, your evaluation skills will be helpful in making wise buying decisions. If you can find both excellent and poor quality hays for the same price, knowing which is the higher quality feed can save you money.

ALFALFA HAY

Quality and Testing

Hay is the principal cash crop for many Oregon farmers. Purchasing hay is the biggest cash expenditure for others. Recognizing quality differences, and their causes, is important to both buyers and producers of hay.

Alfalfa hay is a major forage for ruminant animals. Both hay growers and livestock feeders must realize that there is a wide variation in the quality of hay. Frequently, high-quality and low-quality hay are offered at the same price. In many sales hay is evaluated on a visual basis only, even though it is known that the selections made by experienced hay buyers do not always indicate feed quality accurately. Research and experience show that the combination of visual inspection and chemical analysis greatly improve the accuracy of the predicted nutritive value of hay.

Recognition of the factors that determine hay quality can lead the grower to improve production practices.

Quality Factors

- Stage of maturity. The stage of maturity at cutting influences quality more than variety, production location, soil fertility, or seasonal influences. Alfalfa Hay harvested in the pre-bud or early bud stage will have the highest nutritive value for livestock. Maturity at the time of cutting also makes a great difference in the palatability and digestibility. Palatability and digestibility both decrease as the crop grows older. Some compromise has to be made between quality, however, and optimal yield and persistence of the alfalfa stand. On a yearly basis, early cut hay (late bud to very early flower on alfalfa) yields as much feed (digestible dry matter) per acre as later-cut hay. Early cut hay makes a more desirable feed because it contains more digestible material. Hay cut at this stage is more palatable and is eaten in larger quantities by livestock. This results in less need for supple-

mentation with grain than later-cut hays.

- Leafiness. At least two-thirds of the protein is found in the leaves. Leaf shatter during raking and baling greatly reduces hay quality. The percentage of leaves remaining in the bale is an important indicator of hay quality.

- Color. Bright green color is an indication of proper curing, high carotene content, and good palatability. Any change from a bright green color indicates loss in feed value. However, hays which have slightly sun-bleached or have had a small amount of rain damage will still make high-quality feed.

- Foreign material. This refers to weeds, straw, wire, or other material having little or no feeding value. Foreign material can be harmful, resulting in problems such as loss in palatability and lower consumption or possibly "hardware disease," due to consumption of wire, nails, and similar foreign objects.

- Odor and condition. The smell of new mown hay is the standard with which all odor comparisons should be made. Any other odor, such as a musty or putrid (rotten) odor indicates lowered quality. The causes are storage at too high moisture, or weather damage. Odor problems are associated with lowered livestock acceptability. Dustiness also detracts from the value of hay. The presence of volcanic ash may cause serious respiratory problems especially with horses. Dusty or moldy hay should not be fed to horses or dairy cows, but can be used for beef cows or heifers, which have lower nutritional needs.

The comparison of chemical analysis and visual inspection, shown in Table 1, indicates that the combination gives a reliable indication of quality. Chemical analysis should be used to insure a reliable measure of the items determined, but a visual estimation reveals quality factors such as spoilage, foreign material, and leaf shattering or loss. Routine chemical estimates do not always reflect these factors. Of course, the ultimate measure of hay quality is its palatability and the milk or meat production it supports.

Table 1. Quality Factors and Their Evaluation by Chemical or Visual Means.

Factor	Chemical analysis	Visual inspection
Maturity	Good	Poor
Leafiness	Good	Good
Odor	Fair	Good
Color	Poor	Good
Foreign material	Poor	Good

Sampling and Testing Procedures

A chemical analysis is valid only to the extent that the sample represents the lot of hay under consideration. Com-

mercial forage samplers, such as the "Penn State" forage sampler, are available through farm supply sources. These can be attached to a drill bit or $\frac{1}{2}$ -inch drill for easy sampling.

One 12-to 18-inch core sample taken diagonally from each of 25 bales selected at random constitutes a sufficiently representative sample of a lot of hay to predict its quality. The greater the number of bales sampled, the greater the validity of the test results. A lot of hay should represent hay harvested from the same field, the same cutting, and the same stage of maturity. If two lots of hay are in a stack, sample them separately.

Sampling procedure for cubed hay consists of selecting 40 cubes at random from a lot of 200 tons or less, and placing them in an airtight container for shipment to a laboratory. After grinding, the composite mixture of the 40 cubes is used for analysis.

Ideally, samples should be placed in double thickness polyethylene freezer bags and closed tightly with a rubber band. In this manner the percent dry matter reported will represent the dry matter content of the lot of hay when sampled.

Tests Available

There are several commercial laboratories located in Oregon and neighboring states. Many of these do accurate work at reasonable prices. Your county Extension agent can help you locate a satisfactory laboratory.

The chemical analyses necessary for hay evaluation include moisture, crude protein (CP), neutral detergent fiber (NCF), acid detergent fiber (ADF), calcium (CA), and phosphorus (P). These analyses for one sample will cost about \$20.

When submitting a forage sample, be sure to be specific on what analyses you wish. Some laboratories offer certain groups of selected determinations as a package.

- Moisture. The moisture or water content of hay is important because moisture replaces the nutrients per pound of feed. Moisture is usually lost from newly harvested hay, with the absolute weight loss generally being 5 percent or more. Buyers and sellers should discount hay with over 12 percent moisture to allow for shrinkage due to drying.
- Crude protein (CP). The quality of alfalfa and other legume hays is closely related to its crude protein content, since it is related to stage of maturity. Hay high in protein allows the dairyman to save money by feeding a grain ration low in protein.
- Digestible protein. This, also, can be estimated from crude protein analysis.

- Neutral detergent fiber (NDF). This is the plant fiber that remains after removing cell contents by treatment with a neutral detergent. NDF has been highly correlated with animal dry matter intake (DMI): as NDF increases, DMI decreases.
- Acid detergent fiber (ADF). This is the plant fiber that remains after removing part of the digestible cell wall material with an acid detergent. ADF has been highly correlated with animal digestible dry matter (DDM): as ADF increases, DDM decreases.
- Relative feed value (RFV). RFV is an estimate of overall forage quality. It is calculated from estimates of intake (DMI, via NDF) and digestibility (DDM, via ADF) of forages on a dry-matter basis.
- Modified crude fiber (MCF). Some laboratories estimate total digestible nutrients (TDN) by a MCF test. This test was developed in California as a more rapid fiber test, which has been highly correlated with animal digestibility: as MCF increases, digestibility decreases. Formulas have developed to relate RFV to TDN, but these are estimates. Further research is needed to refine these formulas and to make easier the job of marketing of hay between states.
- Calcium. Since most cereal grains are low in calcium, dairy cattle depend largely on forage for this mineral. Alfalfa hay is a good source of calcium.
- Phosphorus. Most forages are poor sources of phosphorus and need to be supplemented. However, it is important to know the phosphorus content of the forage so that the phosphorus supplement will be used in the proper amount. Today, phosphorus supplements are both expensive and in short supply, so all livestock feeders should avoid overfeeding them. Since the Ca:P ratio is important in dairy rations, both Ca and P analyses should be requested.
- The laboratory report. Since feeding requirements for dairy cows are based on percent dry matter, the forage analysis also should be expressed on this basis. Ration formulation can then be calculated on a least-cost basis.

High-Quality Hay

Dairymen recognize the value of early cut, high-quality hay. Early cut hay is higher in protein and TDN (Table 2), which reduces the quantity of protein and grain supplement that must be fed. The increased palatability of early cut hay also results in greater consumption and higher milk production.

It costs the hay grower more to produce high-quality hay, however, then it does to produce low-quality hay. If there is no economic incentive to produce a higher-quality product, the grower profits most by producing a larger volume of lower-quality hay. Livestock feeders must be willing to pay a premium for high-quality hay.

Table 2. Relationship of the Stage of Alfalfa Maturity at Harvest to Total Digestible Nutrients (TDN), Crude Protein (CP) and Acid Detergent Fiber (ADF) (expressed on dry matter basis).

Maturity	TDN	CP	ADF
	Percent	Percent	Percent
Pre-bud	65	21.7	28
Bud	62	19.9	31
1/10 Bloom	58	17.2	34
$\frac{1}{2}$ Bloom	56	16.0	38
Full Bloom	54	15.0	40
Mature	52	13.6	42

From: Nutrient Requirements of Dairy Cattle, 1978.
National Academy of Science, Publication 1349.

New Hay Grading Standards

New hay standards have been proposed by the American Forage and Grasslands Council and the Federal Grain Inspection Service. Both chemical analyses (CP, NDF, and ADF) and organoleptic characteristics (sight, smell, and touch) have been used to establish hay grades (Table 3)

Table 3. Proposed Market Hay Grades for Alfalfa, Based on Chemical Composition—Crude Protein (CP), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF)—and the Calculated Relative Feed Value (RFV).

Grade	Stage of maturity	CP	NDF	ADF	RFV
1	bud	>19	<40	<31	>140
2	early bloom	17-19	40-45	31-35	124-140
3	mid bloom	13-16	46-51	36-41	101-123
4	full bloom	<13	>51	>41	<100

The different grades of hay should be selected for the particular function required. High-producing cows or beef in a feedlot should be fed hay from Grades 1 or 2. Dry dairy cows and dairy heifers would perform well with Grade 3 hay. Lactating beef cows or lactating ewes could be fed Grade 2 or 3 hay. Dry ewe or beef cattle on a maintenance ration could be fed Grade 4 alfalfa or a grass or cereal hay. Thus, all grades of hay have value if used in the proper feeding situation. Grade 1 alfalfa hay should not be

considered the best hay to feed in all situations. Cost and relative performance required will determine what feed is best for your situation.

FITTING & SHOWING

Instructor Suggestions:

1. Teach students basic information (about 3 days) in the classroom.
2. Spend the last week out at student's projects actually doing fitting and showing.
3. Allow students to fit and show their own animals.
4. Set up a class of 4 or more of each type of livestock. Allow students to show their own livestock. You judge them on their showing and fitting skills.
5. You could use a professional showman to demonstrate for you if one is available.
6. Use information provided to teach the unit or if you have "The Stockmans Handbook" by Ensminger, it has an excellent unit on showing and fitting. (Section X)
7. California has an excellent slide/tape (or film-strip) series on showing and fitting various species of livestock. Secure from Vocational Education Productions, California State Polytechnic University, San Luis Obispo, California 93407.
8. Older students could demonstrate proper fitting and showing for you.

Student Activities:

1. Discuss proper fitting and showing in class and in the field.
2. Properly fit and show beef, sheep and swine.
3. Have a competition within your own FFA chapter on fitting and showing.

OBJECTIVES:

Upon completion of this unit, the student will be able to:

1. Properly fit a beef, sheep or swine.
2. Describe and demonstrate how to show beef, sheep, or swine.
3. Explain proper dress and its importance as related to showing and showmanship.
4. Demonstrate how to trim, oil and clean the feet of beef, sheep and swine.
5. Properly wash and clip beef, sheep and swine.
6. Correctly identify fitting and showing equipment and demonstrate its proper use.

References:

1. "Get in the Winner's Circle:", a magazine by the American Polled Hereford Association, 4700 East 63rd Street, Kansas City, Missouri, 64130
2. 4-H Beef Project, OSU Extension Service (4-H 141)
3. 4-H Sheep Project, Pacific Northwest Extension Publication PNW 181
4. "The Cow", PNW Bulletin 82
5. 4-H Swine Project, OSU Extension Service (4-H 143)
6. Ensminger, M.E., The Stockmans Handbook, 5th edition, 1978, Interstate.
7. "Star of your future", American Angus Association.
8. "Handling & Restraint of Livestock", Student Materials, Texas A&M University.
9. "Blocking & Trimming Sheep", Vocational Agricultural Service, College of Agriculture, University of Illinois, Urbana.
10. "Fitting and Showing FFA Beef", Vocational Education Products, California Polytechnic State University, San Luis Obispo, CA 93401
11. Filmstrips on showing and fitting are also available from California.

Fitting and Showing Swine

Training Your Pigs for Show

It is a pleasure to drive a well-trained pig into the show ring. Livestock judges appreciate the chance to observe and handle well-mannered pigs. On the other hand, they cannot properly judge unruly pigs that cannot be controlled. It is discouraging to show a pig that refuses to do what you want it to do.

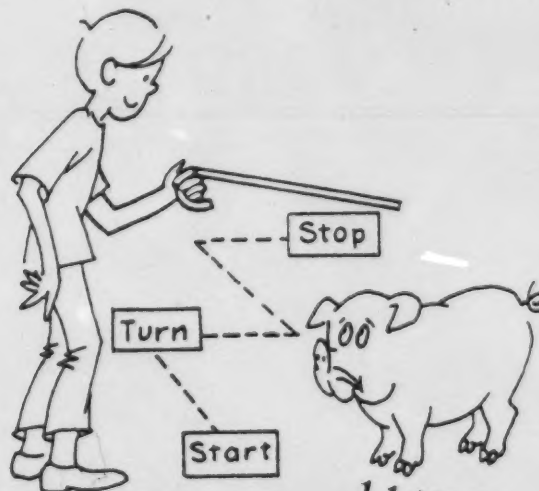
There is no excuse for showing an untrained pig. Of all the farm animals, pigs are the easiest to train because they are the most intelligent. An experienced herdsman can train a pig in less than a week. A beginner should be able to train a pig in two or three weeks. Begin training when your pigs are young. Teach only one lesson at a time. Too much training at one time will confuse a pig.

Train each pig so you can control it at all times with only a cane. You should be able to drive a trained pig anywhere you wish. To do this, train the pig to start, walk, change directions, and stop as you signal it with your cane.

Teach it to stand in a natural position without moving when you stop it. Start the pig moving by tapping it gently on the side of the jowl with your cane. Tap it on the hind leg below the hock to cause it to move forward. An occasional tap will keep it moving. Always show a pig at a slow walk unless the judge signals you to stop for a closer look.

To turn the pig to the left, tap its right jowl. Tap the left jowl to turn it to the right. Don't force your pig to make abrupt turns in the show ring.

Stop the pig by holding the cane in front of its nose. This must be done several times before it will get the idea. Never allow a pig to assume an awkward position when it is standing still. Do not attempt to place the pig's feet by handling them. If the pig is standing in an unnatural position, move it a short distance and stop.



Don't beat on a pig while training. No animal will respond to training if it is given rough treatment. On the other hand, don't try to make a pet out of your pig. A pet pig that wants its back scratched in the show ring is worse than one that has never been handled. It is nearly impossible to get a pet pig to stand in a natural position.

To train a hog properly, daily handling is a "must". It also gives needed exercise.



Exhibiting at the Fair

The fair can be an enjoyable, important event for you. For many it is the climax of the year. You can show your project pigs to the public and compare them with those of other FFA'ers. You can take part in friendly show ring competition and become acquainted with other FFA members.

As a good exhibitor, you will want to be ready when you go to the fair. This means having your pigs trained, washed, and clipped, and your equipment in order. It also includes knowing what to do while you are at the fair.

Going to the fair

You may have to ship your hog to the show by hauling a pickup or some other means. There should be no projecting nails to scratch the hide and no holes in the floor; the truck should be clean. Truck beds should be covered with dry sand to make firm footing for your hog. Do not haul your hog when it has a full stomach. Do not feed it at the regular feeding time before shipping.

When you arrive at the fair

As soon as you get to the fair, locate the swine superintendent and find out where to pen your pigs. Clean the pens and bed them if necessary. When pens are in order, unload your pigs and move them to their pens. Fill their troughs with clean water and let them rest until feeding time.

Care of the hog at the fair is very important. The amount of feed your hog consumes should be reduced to about one half the regular amount to prevent digestive disturbances. Also, exercise your hog daily to keep it in good condition while at the show.



Be a good herdsman

Be a good herdsman while at the fair. Keep your pigs, their pens, and the aisle in front of the pens clean and attractive. Do not leave feed pans and other equipment in the pens after the pigs have eaten. Clean the pens and put in clean, dry bedding each day.

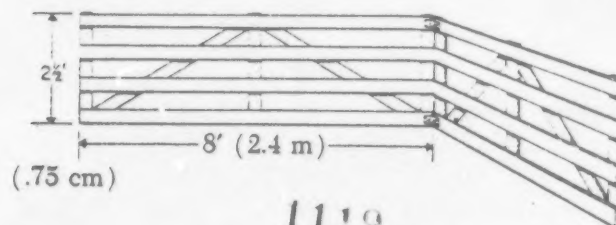
After you have fed your pigs and cleaned their pens, sweep the aisle in front of the pens.

Equipment

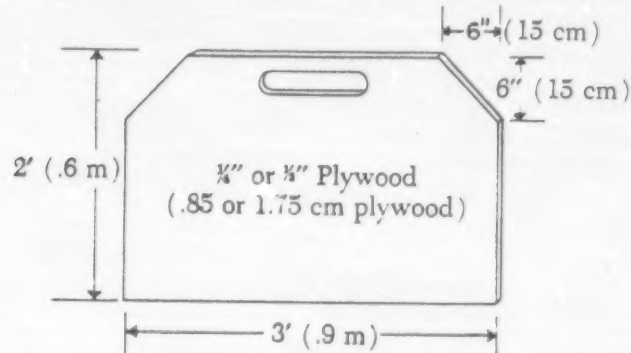
You must have the right kind of equipment if you are to do a good job of feeding, grooming, and showing your pigs. Here is a list of equipment you will need while at the fair:

Feed pans
Water pail
Water troughs
Soap
Scrub brush

Grooming brush
Oil or talcum
Terry cloths
Show cane
Sprinkling can



You may wish to include other items of equipment in your show box. Other equipment might include rubber boots and apron for washing, a plywood hurdle to use in separating pigs if they fight in the show ring, and sprayer to apply oil when grooming pigs. Mark your equipment so it may be easily identified.



Grooming Your Pigs for Show

Grooming is just as important as training when getting pigs ready for show. Proper grooming improves the general appearance of a pig.

General appearance is the first thing a judge notices about a pig. This first impression is important because it gets the judge's attention.

Washing

The most helpful thing you can do in grooming a pig is to wash it. Wash your pig several times before the show and then once about a week before fair time and again the day before the show. Washing your pig will serve as a method of making it gentle and getting it used to people. A small pen will be sufficient to hold your pig while washing.

Before you wash it, rinse the pig with clean water. A bucket of water can be used, but a hose will do a better job.

Be careful when putting water on a pig during hot weather. If possible, wash during the cooler part of the day. It is important you start by washing the legs first and then move to the body of the pig. The shock of cold water on the back of a hot pig can kill.

Rinsing will remove loose dirt and wet the skin and hair before soap is applied. Hold the pig's ears closed when you rinse the head so you won't get water in them. This is especially important at the fair. A pig with water in its ears can be difficult to handle in the show ring.

After the pig has been rinsed, apply enough soap or mild detergent to work up a good lather. Then scrub it well with a stiff brush. Don't forget the underline, the head, and the feet. These parts are often neglected.

If the lather is dirty, rinse it off and start again. A bar of hard water castile soap is good for washing pigs. If you use a mild liquid detergent, mix it with a bucket of warm water and apply it with a brush.

Don't ever use a strong soap or detergent because it will be harmful to the pig's skin. Your advisor can tell you which kind to use.

When you have finished scrubbing, rinse the pig with cold water until all of the soap is gone. Give special attention to the underline and the area between the legs.

Another essential point-remember the inside of the ears. These can be cleaned with a rag.

If you oil the pig after the first washing, you will loosen skin scales. The next washing will easily wash off these scales.

Keep the pig on a clean surface after leaving the wash rack. Take it to a holding pen and dry it as much as possible with a terry cloth towel. Continue to dry the pig by brushing it. Using a dry brush, brush in the direction the hair lies when dry or it will curl up on the sides when the pig lies down.



Clipping

Clipping a pig's tail and ears improves its appearance. This can be done just before you leave for the fair or at the show. You should clip the pig several weeks before fair time for practice. Use either hand clippers or electric barber clippers.

Clip the tail from a point just above the switch to the tail setting. Blend the hair carefully into the rump at the tail setting. Clip the inside and outside of the ears. Clip to the base of the ear where it attaches to the head. Do not clip the head. Blend the clipped area with the unclipped area.

Dressing the hair

After the pig has been washed and clipped, it will be ready for show except for dressing its hair. How the hair is dressed for show will depend on the color of the pig.

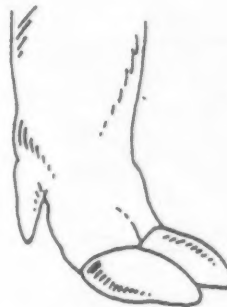
White pigs and the white markings on colored pigs may be sprinkled lightly with talcum powder. Brush the pig lightly after the powder has been applied. Brush in the direction that the hair lays. This will distribute the powder evenly and whiten the skin as well as the hair. Do not use too much powder--just enough to do the job. A mild bleach may be used to remove stains from white hogs.

Colored pigs such as Durocs, Hampshires, Polands, and Berkshires should be oiled with coat dressing or lightweight mineral oil. This gives the hair a sunny, glossy appearance called "bloom." Apply the oil with an old towel. When too much oil is applied, remove excess oil by rubbing with a dry towel. Too much oil has been applied when the hair has a greasy appearance. Don't oil white legs or large white areas on the body.

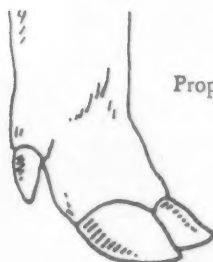
Trimming the feet will allow the hog to stand properly on its feet. This should be done at least a month ahead of show time to get away from any lameness that might develop from cutting too closely. A sharp pocket knife may be used.



Toes spread too much. Outside toe needs to turn inward more.



Toes and dew claws too long; need trimming.



Properly trimmed foot.

The final grooming

Pigs are easy to groom for the show ring. If you clipped your pigs before you left home, there are only two grooming steps to do at the fair. The first and most important step is to wash your pigs. Do this early in the morning on show day or during the evening before show day.

The second grooming step is to powder or oil your pigs, depending on their color. White pigs should be powdered with talcum powder, and colored pigs should be oiled lightly. Spotted pigs or belted pigs can be powdered and oiled, but you must be careful to get the powder and the oil in the right places.

Your grooming

Your appearance in the ring will make a big impression on the judge during conformation and showmanship classes. You should be clean and neat. This means that you and your clothes should be clean, your clothes neatly pressed, and your hair neatly trimmed and combed.

When showing, girls should wear a blouse or sweater that can be closed at the throat. Skirts, shorts, and bare midriffs are not appropriate. Pants are best. For boys, a shirt and long pants are appropriate. Colored clothing is perfectly acceptable and in many cases most practical when showing your hog.

Shoes should be sturdy and provide protection for the feet. Thongs, sandals, and bare feet are not appropriate.

Your courtesy in the ring speaks loudly for your attitude. Be considerate of others. You should respond readily to the requests from the judge or ringmaster. Do not jerk, strike, or abuse your animals or use inappropriate language.

You will do much to impress the judge and those watching you in the ring if you keep a cool, calm attitude and move quietly and with confidence. You do not need to be too serious; you should relax and smile.

It is important that you be a modest winner or a gracious loser. Be quick to compliment the others in the ring. Do not criticize or complain when you do not win. Remember, losers often learn more than the winners in the show ring.

Showing your pigs.

Take your pigs promptly to the show ring when the class is called. Don't hurry the pig either on the way to the ring or while you are showing. Even a well-trained pig can be difficult to show when it becomes excited. This is especially true during hot weather.

Do not strike your hog with a cane or whip because hogs bruise easily; bruises reduce the value of the carcass. Whipping a hog in the show ring shows your lack of ability

as a showperson.

Show your pig so the judge will get a good look at it. Do this by moving the pig slowly, giving the judge a side view at a distance of 10 to 20 feet (3 to 6 m). Don't crowd the judge. The judge will come to you if he or she wants a closer look at your pig.

Watch the judge and carry out the instructions. If he or she wants a closer look, stop your pig. When you are told to put your pig in a holding pin, do it promptly but without abusing the pig. Never try to force your pig to move by pushing it. If pigs fight, don't step between them. Let someone with a hog hurdle help. Above all, don't lose your temper and mistreat your pig. Such conduct is the mark of a poor showperson and will only lead to more difficulty in handling the pig.

After the show

Once your pigs class has been judged, take your pig back to its pen and let it rest. Check your equipment to be sure you still have all of it. Equipment is often misplaced during the last-minute rush of getting a pig ready for the show ring.

When you are through showing, wash your pigs, and clean their pens. Keep the pigs, their pens, and the area around the pens clean. You want to present your exhibit to the public in the best manner possible.

You can gain enjoyment and valuable experience from working with the swine project. By learning from those experiences, you the FFA member can strive to "Learn by Doing"

Teaching the calf to back

The final training step is to teach the calf to back. This training may come in handy at your county fair. While showing, you will be asked to change positions in the show line. The class may be lined up along the outside of the arena facing a wall or fence. In such an instance, you will have to back your calf out of line to move it. A calf will not back unless it has been trained to do so. This is the way to teach a calf to back:

- Push the point of its shoulder with your right hand. At the same time, apply backward pressure on the halter with your left hand.
- As it backs, guide the calf in a straight line with the halter lead. Guide the calf by using left and right pressure on the lead strap.
- When it will back in a straight line, begin backing the calf without pushing on its shoulder. In other words, use only the lead strap.

- Never try to back a calf by prodding it with your show stick. If you do, the calf will regard show sticks as weapons.

You will have trouble at first because the calf will not know what is expected of it. Also, when it does start to back, you will have trouble backing it in a straight line; therefore, you must be patient with the calf. With patience, and repeated efforts, you will soon have it backing with ease.

Working with your animal each day will teach it to become gentle. Having several people feel the animal over its back will accustom it to handling when being judged at the show. An animal that a judge cannot handle is at a definite disadvantage in a livestock show.

Equipment needs

Certain equipment should be obtained early in your program so that you and your calf will become used to it.

Essential equipment includes:

- Leather show halter (optional)
- Adjustable rope halter
- Show stick
- Round curry comb
- Scotch comb
- Stiff brush for washing
- Rice brush and comb
- Two galvanized feed buckets
- Soft rubbing cloths or rags
- Pitchfork
- Pail
- Clippers

A show box is convenient for storing and transporting equipment. Many show boxes are about 3 feet long, 2 feet wide, and 1 1/2 feet deep. You may wish to have your own electric clippers and tools for trimming and polishing hooves and horns.

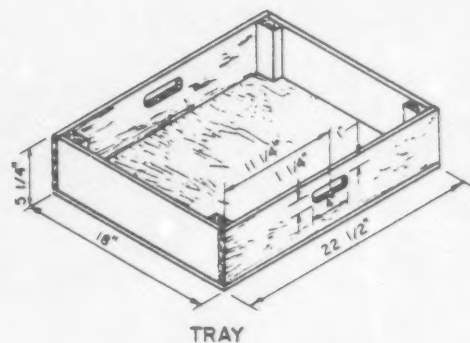
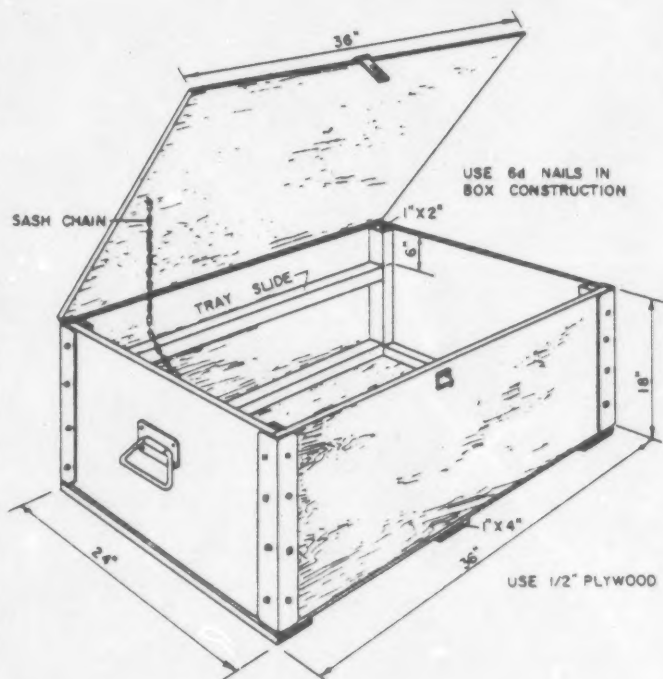
A box is helpful for storing and transporting show equipment. Reinforced metal corners strengthen the box illustrated.

Proper grooming improves the general appearance of a calf -- the first thing a judge notices. First impressions influence the judge's opinion of the calf.

Below are items of equipment needed for training and showing your calf:



Show Box



Care of the hair

You can improve your calf's appearance by taking special care of its hair during the summer. Calves always look better in the show ring when they have good, well-groomed hair coats.

Washing your calf

Regular washings keep hair and skin clean and healthy.

Wash your calf every week or 10 days during the summer, and at least once each week during the last month before the show. Before starting to wash your animal, have all of your equipment ready. A well-drained area or washing stand helps to keep you out of the mud. Make sure that your animal is secured with a neckchain, because it may pull back when it is being wet down, especially for the first time.

Never use a neck rope because it will shrink when it dries. On some animals, a wet rope will stain white hair.

Several soaps are suitable. Liquid soap is handy, and some brands are made especially for cattle. Before wetting your animal with soap or water, brush thoroughly to remove dandruff, dust and dirt. When doing this preliminary brushing, brush in the direction that the hair naturally lies.

Begin washing by first wetting the feet and legs, then the body. Avoid getting water into the ears by holding the ear downward or closed. While the animal is wet, apply soap and rub into a rich lather. After thoroughly washing, rinse with clean water, again holding the ears so water does not get into them. Make sure that no soap is left in the hair, as it will irritate the skin.

After water has been scraped off and the animal allowed to drain, the rest of the moisture can be removed by brushing or by using electric grooming equipment.

After the damp hair has been thoroughly brushed down, it is ready to curl.

Growing hair

It is natural for a beef animal to grow a good coat of hair in the winter and shed it in the spring. However, you can stimulate hair growth during the summer.

The easiest way to stimulate hair growth is to clip the calf's entire body above the hocks. Do this during the last 2 weeks in April. Clip the body in the same manner that you clip the head and tail. This will remove all of the winter hair coat and start a new coat developing several weeks earlier than normal.

In addition to clipping, hair growth can be stimulated by following this daily routine beginning in early June:

- Keep the calf in a cool, shady place during the daytime. An electric fan will help keep the calf cool, but an evaporation-type air cooler is even better.
- Soak the calf thoroughly with water in the cool of the evening and curl its hair. Do the same thing early in the morning.
- Shut the calf in its exercise lot at night. It is usually cooler outside at night than in a shed or barn.

The objective is to keep the calf as cool as possible both day and night. Some people believe hair growth is stimulated by merely curling and brushing the calf. This is not true. Keeping a calf cool is a secret to growing hair. You curl and brush a calf to train hair and improve its quality, not to stimulate its growth.

Curling or dressing hair

Not all breeds have a hair coat heavy enough to curl, so let your fitting and grooming conform to what is best for your animal. After every washing, hair should be curled so it will present a thick, glossy appearance by show time. Hair is usually curled by pulling the edge of a round curry comb through it in a zigzag motion from top to the lower part of the animal's side. After the entire body has been curled, brush hair upward with your brush in one hand and scotch comb in the other. Brush and comb using upward strokes over the entire body until the animal is dry. Hair on the back of the hindquarters is not curled but is brushed from the center to the outside to give a wider appearance. Hair on the top of the crest can be parted and combed to each side or it can be pulled straight forward. After washing and thoroughly brushing, leave your calf in the sunshine, if possible, until the hair coat is completely dry.

Wash your calf thoroughly the day before a show. Provide clean straw for bedding, where the calf can be kept clean and comfortable. About an hour before show time, wet the hair slightly and again give it a curl and brush upward. Do not get the animal too wet; it should be dry when it enters the ring.

Clipping

Before clipping, carefully look the animal over and see just where improvement can be made. It is usually desirable to clip the head and tail of a steer in order to give a neat appearance. On animals shown in breeding classes, the head may or may not be clipped. Become familiar with what is desirable for your breed and clip accordingly.

Whether you are showing steers or breeding cattle, it is customary to clip excess hair from the belly and brisket and possibly from the flank.

When clipping, ask directions or assistance from persons with experience. Whatever is clipped away takes a long time to grow back out. Do not take too much hair off the top of the tailhead. By skillful use of a comb and scissors, the rump and tailhead can be blended smoothly so that the clipped area does not stand out too distinctly from the unclipped area.

Blocking calves is done, but is not necessary. Blocking is accomplished by shearing hair off the brisket and belly and leaving hair as full as possible on the sides of the animal. The top line is carefully clipped to give a wide, smooth and level appearance. Do not clip the back too close to the skin. Round the back off into the sides to give a slightly curbed or rounded appearance rather than a definite squared effect.

A thick, healthy coat of clean and lustrous hair is an asset to a show animal. Keep in mind that hair normally is shed in the spring and does not grow much in the summer.

Clipping the head and tail

Clipping the head and tail of a market heifer or steer is an accepted practice throughout the country. A correctly clipped market calf has a more neat, trim and pleasing appearance. The practice of clipping breeding heifers varies according to established customs among breeds. Clip according to the custom of the breed.

Clipping market steers and heifers

Clip both head and tail of a polled or dehorned market heifer or steer regardless of the breed. This rule also applies to calves with scurs or stub horns.

Market heifers or steers with horns should not be shown. However, if you do show a calf that has horns, do not make a second mistake by clipping its head.



Clipping breeding heifers

Clip the head and tail of an Angus breeding heifer. Only Angus breeders recognize the practice of clipping the head of a breeding heifer.

Clip only the tail of a Hereford breeding heifer. This rule applies to both polled and horned heifers of the Hereford breed.

Do not clip either the head or tail of a Shorthorn breeding heifer. This rule applies to both polled and horned heifers of the Shorthorn breed.

When to clip

Clip 4 to 7 days before the calf is shown. This allows time for hair to grow out enough to give a smooth appearance.

Clip the tail first

A calf will give you less trouble if you clip the tail first. Before clipping the tail, however, let the calf feel the vibration of the clippers on the tail-head. Clip tail upward from a point about 1 inch above beginning of the twist. The twist begins at the point where the legs meet when viewed from the rear.

Do not clip the tailhead. Trim the hair on the tailhead with a comb and a pair of scissors so that the tail and tailhead blend.

Clipping the head

Before clipping the head, let the calf feel the vibration of the clippers on its forehead. Always clip in the opposite direction from the way the hair lies. This will result in a closer, smoother clip. Be careful not to clip the eye lashes.

Two methods are used to clip the head of calves for shows. Either method is acceptable:

1. Some people clip only the upper part of the head. With this method, establish a line from just below the ear to the corner of the mouth. Clip all hair above this line, including a clipper's width behind the poll.
2. Most people clip the entire head. Clip line is from a point about a clipper's width behind the poll straight down on either side of the neck. Clip all hair in front of this line. Regardless of method used, never clip the ears.

Care of clippers

Electric clippers are expensive and should be maintained properly. Before and after use, clean and oil the clippers. Wash the head and tail of the calf before clipping to prevent unnecessary dulling of clipper blades.

To clean blades, dip the head of the clippers in kerosene or diesel fuel while running. Do this after you clip the tail, and two or three times while you are clipping the head. Do not use gasoline to clean clippers.

Use special care at the show

The calf should not be too full during the time it is being trucked from home to a show. After arriving at the show grounds, locate your assigned stall area. Put down fresh bedding and fluff it up. Cattle should have time to rest and should be given just a small amount of hay on arrival at the show grounds. Being away from home and in strange surroundings may cut down on appetite, so do not feed quite as much grain as you ordinarily do at home.

City water is often chlorinated, so there may be reluctance to drink. One way of overcoming the problem of strange tasting water is to add a small amount of molasses to the drinking water for about a week before leaving home, continuing it at the show. One or two tablespoons in a bucket of water is enough.

Your grooming

Your own appearance in the ring makes a big impression on the judge. You should be clean and neat. This means that you and your clothes should be clean, your clothes neatly pressed, and your hair neatly trimmed and combed.

When showing, FFA members should be in official dress.

Shoes should be sturdy and provide protection. Thongs, sandals and bare feet are not appropriate.

Be courteous in the ring, and considerate of others. Respond readily to requests from the judge or ringmaster. Do not jerk, strike or abuse your animal, or use abusive language.

You will do much to impress the judge and those watching you in the ring if you keep a cool, calm attitude and move quietly and with confidence.

Be a modest winner or a gracious loser. Be quick to compliment others in the ring. Do not criticize or complain when you do not win. Remember, losers often learn more than winners in the show ring, and there will be more shows.

In the show ring

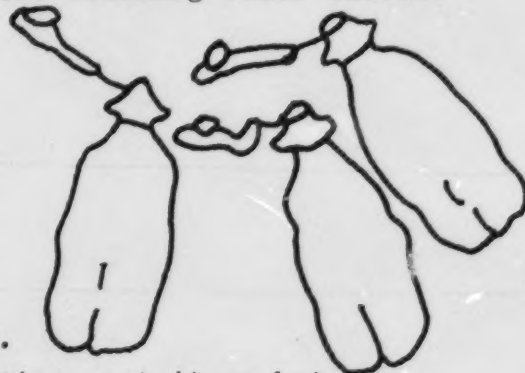
Before entering the show ring make sure your animal is clean and well brushed and has a desirable amount of fill. If you allow only a small amount of water the night before the show, the animal will be ready to drink to a normal fill before going into the show ring. Getting a normal fill takes skill and practice. Don't change the routine very much from what the animal is accustomed to at home.

When your class is called into the ring, follow instructions of the judge and line up as told. If you have taught your animal to lead and stand properly this should be a great asset during the time of showing. Be attentive to the judge so that you are able to follow instructions.

Showing your calf

Lead your calf promptly to the show ring. As you enter, remember that many judges watch cattle come into the ring and the first impression is very important. Lead the calf from the left side with the strap in your right hand about 18 inches from the calf's head. Walk at a moderate pace and watch for instruction from the judge or ringmaster. The ringmaster or suprintendent will direct you to your proper place. In lining up your calf, allow about 3 feet on either side so the judge can walk around your calf without touching other calves.

DON'T CROWD YOUR
NEIGHBOR



Don't crowd your neighbor.

Once your calf is in position, set it up but do not continue to work with it until judging begins. When judging begins, set your calf up again, making sure that both front and hind feet are properly placed. Keep its head up and its back straight. With the show stick, apply firm pressure neat the navel to help keep a weak-topped calf's back straighter. Calves with high loin should be pinched down to straighten their tops. Calves that tend to be "cow hocked" can be made to look straight by pulling out on the hocks with your hand.

When judges handle your calf you should react as follows. If you think your calf may be slightly fat or too soft, turn the calf's head to the side away from the judge. If you think your calf is too bare, turn its head to the side toward the judge. After the judge handles your calf, comb the hair up where the judge handled it. Do not block the judge's view of your calf and keep track of the judge and your calf. Be careful not to over show yourself. Remember, when showing an animal, move quietly so your animal is the center of attention.

Allow your calf to "stand at ease" if you are in a big class and the judge is working at the other end of the ring. Scratch your calf with the show stick and let it rest some until the judge starts back to your end of the ring.

Watch the judge for instructions. When the judge signals for the class to be paraded, move your calf promptly. Lead from the left side of the calf. Carry your show stick in your left hand and lead with your right hand. Hold the lead strap about 15 inches from the calf's head with the remainder folded neatly in your hand.

Don't fight your calf if it becomes restless and nervous. Work gently and get it to lead and stand as well as you can. Above all, don't lose your temper and mistreat the calf.

In moving out of line and moving into another position, there are three general situations that you will encounter. The first of these is when you are pulled in very close to the rail. In this case, you have only one choice. Back your calf out of line and lead it to a new position. The second situation is when you are near the center of the line and have plenty of room between your calf's head and the rail. When signaled to move, pull your calf forward toward the rail, circle right and move back through the space you just vacated. When you have moved into the center of the ring, you may then move into the position the judge has indicated. The third situation you may encounter is that of standing near one end of the line and having ample room between your calf's head and the rail. In this case, when you are signaled to move, circle the end of the line and pull back into the position the judge has indicated.

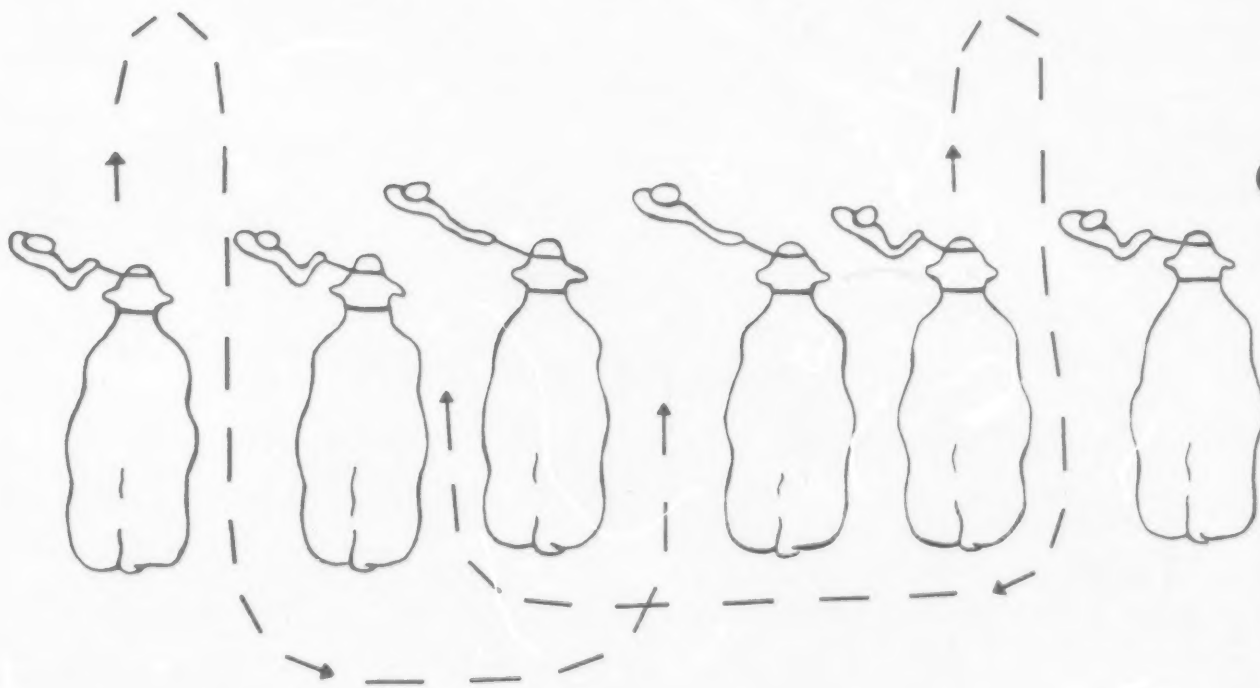
When the judge signals the whole line to move, circle in a clockwise direction. Keep your eye on the judge as you are moving in order to stop and not run up on the calf in front of you. If the calf in front of you stops, tap it gently on the rear until it moves once again. When you stop, set the calf up immediately. When the judge moves you on, pull out and move back into the same position you were in before, unless instructed otherwise.

When the judge walks up to inspect your animal, rub the show stick lightly under the animal's stomach, as this will tend to quiet it. If you have an animal that kicks, you should mention it. Judges don't enjoy getting kicked. When the judge moves around in front of your animal, switch the show stick to your left hand and the lead strap to your right and step back on the left side of your animal so the judge can see its head.

When in the show ring, be quiet and deliberate in your movements; always work with an air of dignity. Do not become excited when you show because the animal can sense this and it tends to excite it.

A common fault is overshadowing. The basic purpose of showing is to present your animal in its best appearance before the judge. This is not accomplished if you are stealing the show yourself and the judge is watching you instead of the animal. Avoid any unnecessary "showy" movements. Make it appear as if the animal is showing itself.

One fault of some exhibitors is that their minds wander away from what is going on in the show ring. This is the time to show your animal and yourself to the best of your ability, so pay close attention and follow instructions. Never quit showing until the class has been placed. Even then, show your animal so that it makes a very presentable appearance.



When in line and asked to move, you may back your calf out of preferably pull it ahead; Turn it to the right, passing back through your original slot and lead it to a new space passing the rear of the line of animals.

Care of equipment

Most show equipment is sturdy and built to last for many year. Even the most durable piece of equipment, however, is apt to break or wear out prematurely when used carelessly. Take good care of your show equipment, both at home and at the fair.

Always put each piece of equipment back in the show box as soon as you are through with it. While at the fair, check your equipment daily to be sure that you have not misplaced any of it. The inventory will be easier if you tack a list of equipment on the inside of the show box lid.

Marketing your cattle

When steers are shown at a county fair or larger stock show, it is customary for them to be sold through an auction following the show.

In order for a steer to be sold in an auction he must be weighed and identified. It is up to each seller of an animal to become familiar with requirements for sale. When in the sale arena with your animal, be sure that you display the animal so that it will look its best.

After the auction, give whatever assistance is needed in caring for the animal you have just sold.

Get the name and address of the buyer so you can thank them properly with a written letter. If your animal does not bring as much money as you had hoped for, be thankful that someone did buy. Express your appreciation to the buyer.

Breeding animals, such as heifers, are usually sold by private treaty. When selling by private treaty, make sure you know approximately what your animals are worth from sales of comparable animals and set the price accordingly.

When selling registered breeding stock, you are responsible for transferring registration papers to the new owner. Make this transaction as rapidly as possible. Make sure that the buyer's name and address are correct. Have the buyer write down how the new ownership should appear on the registration paper.

Strict honesty must be practiced in all business dealings. Remember, whoever buys your product is buying partly because of faith in you.

FITTING AND SHOWING SHEEP

Fitting and Showing

Many FFA members like the fun and excitement of the fair, and you may want to show some of your lambs at a fair. Showing will also give you a chance to compare your project lambs with those of others and have them evaluated by a competent individual.

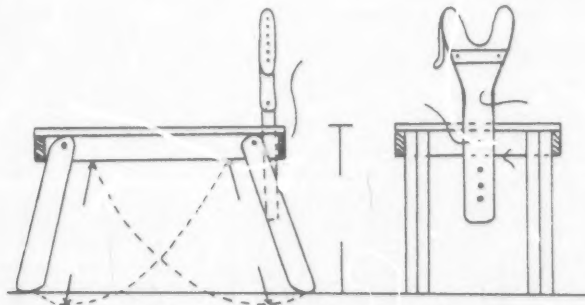
When you take your sheep to the fair, you will want it to look its very best, and you also will want to look your best.

Fitting lambs consists mainly of preparing the fleece and teaching the lamb to show, with some attention to feet and legs. It is your responsibility to prepare your lamb so it will show to its best advantage.

Fitting and training should begin at least 6 weeks before the fair. You must do all the training and fitting.

Equipment

You will need a "fitting stand" to hold your lamb in position while you clean and trim its fleece. The illustrations show how you can make and use the fitting stand.



Equipment you need for trimming and blocking:

- | | |
|-------------------------------|--------------------|
| 1. Bucket | 5. Curry comb |
| 2. Shears | 6. Scrubbing brush |
| 3. Stone for sharpening shear | 7. Hoof trimmers |
| 4. Wool card | 8. Scrubbing cloth |

Training your lambs

You must work with your lambs until they are gentle so you can start training them. No lamb will respond to your training until it has accepted you as a friend. Do not get in a hurry--take a month if needed. Start by visiting your lambs 2 or 3 times a day for a week but don't handle them. Sit and watch them as they eat or move about. During the second week, pet the lambs while they eat.

During the third week, catch and handle each lamb now and then. By the end of a month, the lambs will be ready to train.

Work with the sheep until it is gentle and will lead or stand as you desire. A few minutes a day for several weeks is much better than several hours a day, just before the fair.

The first step is to train the lamb so you can control it and move it about.

To move a lamb, stand on its left side, grasp under the chin with your left hand and put your right hand on the dock. Guide the lamb with your left hand and move it by pressing on the dock with your right hand. Don't put your right hand on the back of your lamb's head. After your lamb learns to move forward you may be able to lead it with a gentle tug with your left hand.

Work with each lamb a little each day until you can move them about with ease. Never work with a lamb for long periods of time or it will become restless and stubborn.



The next step is to train the lamb so you can set it up. The lamb should stand patiently with the front and hind legs wide apart. The head should be held erect and slightly raised. Always work on the left side of the lamb. Set the lamb up by moving its feet into proper position squarely under the body, with your hands.



Never grasp the legs as you would a baseball bat. Move the leg by gently applying pressure to the inside or the outside of the leg with an open hand. Again, don't expect the lamb to learn too quickly. You will accomplish more by working it frequently, for short periods of time.

Teach your sheep to stand quietly when someone comes up and handles it. Always hold it so it cannot get away. Do not make sudden moves. Never pull its wool.

The final training phase will be "bracing" the lamb. Bracing means that the lamb holds its back rigid (stiff) when you press on it. Brace a lamb by getting in front of it and grasping under the chin with both hands. Pull downward with your hands and apply enough backward pressure to cause the lamb to bow its back. Do not choke the lamb or grasp so hard that you hurt it. Have someone act as a judge and handle the lamb's back as you practice bracing it.



Condition or fleshing

Market lambs should be properly finished, ready for market but not over finished. Breeding animals should be in good condition for breeding, not too fat.

Grooming

General appearance is the first thing a livestock judge notices about an animal in the show ring. This first impression is important because it influences the judge's opinion of the lamb. Proper grooming will not help a lamb of red ribbon quality win a blue ribbon; however, it will often make the difference between a lamb being placed a top blue instead of a 2nd or 3rd place blue.

Shearing your lambs

The most important thing you can do in grooming most lambs for show is to have them sheared. Do this about 2 months before fair time. A lamb of the down breeds should have fleece about 1/4 inch in length (.6 cm) when shown, long wool breeds, however, should be shown in full fleece. Shearing will eliminate most of the work of cutting the fleece down to proper length with trimming shears at fair time. Shearing also will accomplish three other things; the lambs will be cooler during hot weather, they will put on faster gains, and they will stay on full feed more easily.

Trimming the feet

You should keep the hooves of your lamb trimmed throughout the feeding period. In the Northwest, this is usually 3 or 4 times a year. When you keep its feet properly trimmed, your lamb will stand straighter on its legs and will be straighter and stronger in its back.



Trim the hooves of your lamb carefully several weeks before the show. It will then have time to overcome any lameness that results from the foot trimming before the show.

Show animals should have their feet trimmed before fair time and before final fitting is done on the fleece.

Cleanliness

Remove burrs, straw, dung locks and dirt by brushing, carding and trimming during the fitting period. Do not pasture your sheep where there are briars or cockleburs, and do not use an overhead feeder during the fitting period.

Washing a lamb

Dirty sheep or those with excessive amounts of soiled area should be washed. Blanketing will help to remove some of the dirt and keep sheep clean without washing.

It is a common practice for Pacific Northwesters to wash market lambs when getting them ready for show. They do it for one reason--to make the lambs look more attractive. Washing does improve the appearance of a lamb.



A lamb should be washed only once--2 or 3 weeks before the fair. Washing removes lanolin (natural oil) from the fleece. Lanolin is necessary to give body to the fleece. Washing too near the fair will not allow enough time for lanolin to be replaced by the lamb's body. Sheep washed just before showing may be scored down by the judge.

A lamb that was not sheared earlier should be trimmed before it is washed. Trim the fleece to a length of no more than 1/4 inch (.6 cm).

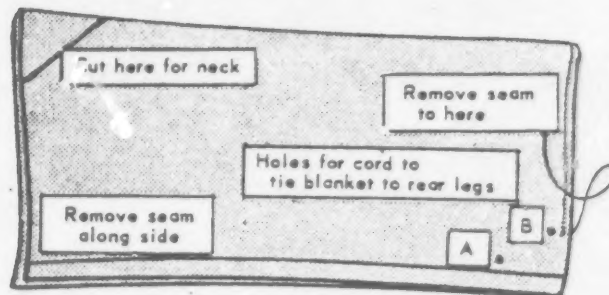
Wash on a warm day, in the morning, to allow time for the animal to dry. Use a mild soap and warm water.

Put the lamb in a tub of warm soapy water and scrub with a stiff brush. Pay special attention to the areas of the belly, under the legs, and the crotch. Rinse the lamb with a hose until you are sure all soap has been removed. Do not use a nozzle on the hose. Hold the end of the hose next to the skin and move it in a circular, scrubbing motion.

Remove excess water from the fleece with your hands or with a flat edge such as a wool card. Dry the fleece as much as possible with a terry cloth towel. Keep the lamb in a clean, well bedded pen until fair time. Keep the pen bedded about 6 inches (15 cm) deep with clean, dry, fluffy straw. Blanket your lamb when it is dry to keep it clean.

Blanketing

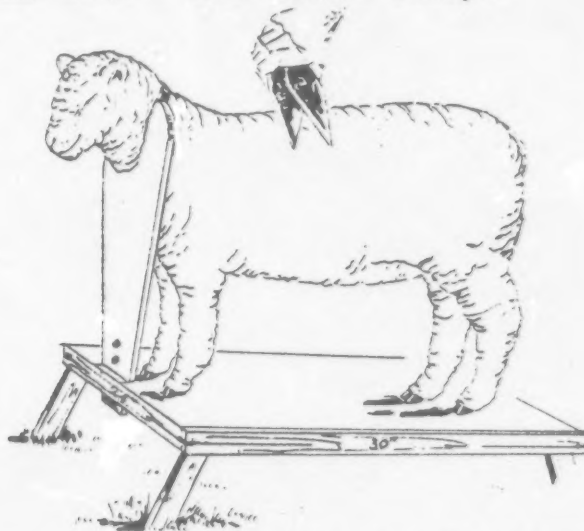
Blanketing for 4 to 6 weeks before the show will improve the appearance of your sheep. Blanketing helps distribute the natural oils evenly throughout the fleece and helps keep your sheep clean. Before blanketing your sheep, use a round curry comb or brush to remove surface dirt and foreign materials.



A sheep blanket can be made from a clean burlap sack. Open a sack down one side almost to the corner, leaving 6 to 10 inches fastened together at the corner to fit over the sheep's brisket; then open just enough of the end for the sheep's head and neck. Put the sheep's head through the hole in the bottom of the sack. A twine loop or cotton string for the rear legs will hold the blanket in place.

Trimming the fleece

Very little work is required to trim a lamb for show if it was sheared early in the project; however, at least 5 hours of carding and trimming are necessary to get a lamb with a full fleece ready.



The purpose of trimming a lamb is to remove fleece over the entire body to a desired length. Trimming the fleece makes the sheep appear smoother, longer and broader. Only medium wool (down type) breeds of sheep are fitted. Trim just enough to present a neat appearance and bring out good conformation (shape). Fwes for breeding should not be trimmed as closely as market lambs. Do not trim too deeply.

Trim the fleece to a length of $\frac{1}{4}$ inch (1.3 cm) three weeks before the fair and wash the lamb, if you wish. Wait until a few days before the fair and trim the fleece again. This time, trim to a length of $\frac{1}{4}$ inch (.6 cm). This last trimming should be done carefully so the fleece is smooth and ready for show. By doing this, you will need only to dampen, card and trim off the rough edges at the fair.

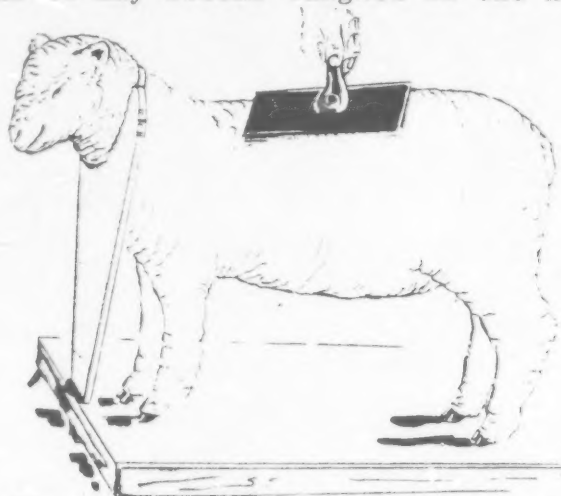
"Long wool" sheep require a minimum of trimming. Trim only the tips of the fleece to smooth the sheep. Cut the back down very little or not at all.

You will need the following equipment when you trim your lambs:

- | | |
|------------------|---------------------|
| 1. Fitting stand | 5. Curry comb |
| 2. Water pail | 6. Sharpening stone |
| 3. Stock dip | 7. Stiff brush |
| 4. Sheep shears | 8. Clean rag |

Following are suggestions for trimming your lambs.

Place sheep on a fitting stand if one is available. If not, use a sheep halter to tie the animal securely. (If you use a sheep halter do not go away and leave the animal tied, as it may become tangled in the halter and choke).



Use a spring-type curry comb to remove dirt, burrs, hay and other foreign matter from the fleece. Do a good job with the curry comb before wetting your lamb.

Dip a clean rag in water, wring out excess water and dampen the fleece by rubbing briskly. Do not soak the fleece.

Dampen the fleece by brushing lightly, using a small amount of water. One-fourth teaspoon of sheep dip per gallon of water will help to clean fleece and aid in straightening wool fibers.

Card the damp fleece to straighten out the ends for

trimming. Do not card too much in one place.

An old kitchen fork with the times bent at right angles is handy for cleaning wool from the card.

Trim off the tips of all carded wool, using the shears in such a manner that a uniform, even cut is made. Trim lightly; card and trim several time until a smooth, even surface is obtained. Clipping a small amount of wool each time will give a smoother fleece than taking large cuts.

In trimming the wool, cut just enough to leave the fleece smooth and attractive after carding. Fitting should be done in such a manner as to display the natural contour of the body when viewed from the rear. Flatness and squareness are associated with overly fat lambs and so create an impression which is not desirable.

Card out each area before you touch it with shears. If the wool gets matted down before you finish trimming the particular area, card it again before you complete the trimming. Frequent carding will be required to cause the longer wool to stand out.

Use a #2 or #3 card, which is designed for heavy, dense fleeces. Some members also like a leg and head card. When using the card, roll the card from the handle to the front of the card. Be sure to keep the card square on sheep. As you roll the card, bring the card up to straighten the fibers.

When using the shears, the lower blade should not move. Do all the clipping with the upper blade. Trim with hind shears by holding the handle of the bottom blade against your palm and thumb, moving only the top blade by flexing your fingers. This will take practice. As you clip with the upper blade, move the shears slowly away from you so you will get the effect of using a lawnmower. Hold the shears at a right angle to the line of trimming.

Begin by holding the shears in the palm of the hand and thumb. Place the shears flat on the surface to be trimmed and tilt slightly up. Move the shears forward so the bottom blade glides slowly and smoothly. As the bottom blades move forward, clip the fleece by repeatedly pulling the top blade back to the bottom blade and releasing it. As you trim, stop often and dip the shears in water to clean them. Always keep the blades of the shears wet when trimming.

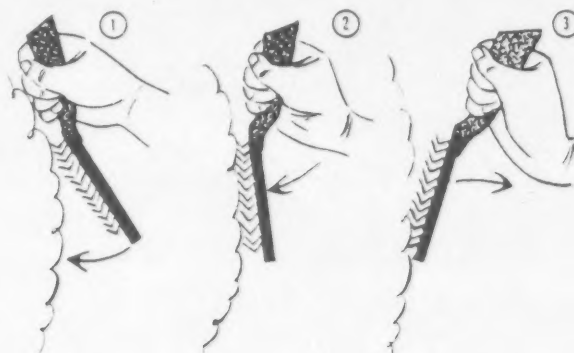
The following general procedure is suggested for trimming:

Trim the back area to the width of the sheep's back. Level the top by clipping from front to rear.

Trim the brisket and shoulder. Compact the fleece by patting lightly with a small flat plywood paddle or the back of the wool card. Moisten lightly when compacting by dipping the paddle or wool card in water. Shake off surplus water compacting the wool. Then trim under the neck to form a deep, solid, appearing chest.

Square the dock (stub of the tail); trim the twist and rear legs. Be sure you card the wool out before trimming the rear quarters. When you trim the legs, be sure you show the

muscle of the leg. To show a well filled twist and full rear quarter, trim only enough wool to make a smooth appearance.



How to use the wool card in fitting your lamb: (1) and (2) pat card into fleece; (3) roll card out of fleece. Never try to rake the card through the fleece.

Trim sides, blending the side into the back area, brisket, and rear quarter by working mostly with the points of the shears. Smooth the left side from the front to the back; smooth the right side from the dock forward.

Trim the head and neck, bringing out the characteristics of your breed. It is a good practice to trim the wool around the eyes of sheep inclined to be wool blind.

It may be desirable to shorten the wool under the belly to more clearly show the length of the body and height of the body from the ground.

After the first or second trim, put the blanket on your lamb to keep it clean.

Grooming breeding ewes

Breeding ewes are groomed differently than market lambs. They are shown with a longer fleece because wool quality is considered when breeding sheep are judged. They should not be washed because natural oils in fleece are necessary to give the wool character.

The fleece of breeding ewes should be three-fourths to one inch in length at show time. For this reason, ewe lambs should not be sheared and older ewes should be sheared no later than April 1.

Upon arrival at the fair

Locate your pen as soon as you arrive at the fair. Clean the pen and bed it with clean, dry straw. Pen your lambs, leave a pail of water for them, and let them rest until feeding time. Find out from the show superintendent when you should have the lambs ready to show.

Feeding and watering

Feed your lambs at the fair the same way you do at home. Use fresh feed each time and remove any feed

the lambs do not clean up in 15 minutes. Do not make any changes in the ration during the fair. Changes in the ration should be made at home a week or two before you leave for the fair.

If the fair has chlorine in the water, your lambs may refuse to drink the water. This situation can be overcome by adding a teaspoon of molasses per gallon of drinking water during the last 2 weeks at home. The lambs will get accustomed to the molasses taste. Molasses added to the drinking water at the fair will cover up the chlorine taste.

Care of equipment

Most show equipment is sturdy and built to last for many years; however, even the most durable piece of equipment is apt to break or wear out prematurely when used carelessly. A good showman takes care of his equipment at home and at the fair.

Always put each piece of equipment back into the show box as soon as you are through with it. While at the fair, check your equipment daily to be sure that you have not misplaced any of it. The inventory will be easier if you tack a list of equipment on the inside of the show box lid.

Do not abuse any of the equipment but use it only for the purpose for which it was made. Reduce losses at the fair by marking all the equipment so that it can be identified as yours. Keep your equipment in good condition by making repairs promptly when the need arises. Clean and dry each piece when you have finished using it.

Your personal grooming

Your appearance in the ring will make a big impression on the judge during conformation and showmanship classes. Be clean and neat. This means that you and your clothes should be clean, your clothes neatly pressed, and your hair neatly trimmed and combed.

Girls should wear a blouse or sweater that can be closed at the throat. Skirts, shorts and bare midriffs are not appropriate. Pants are best. For boys, a shirt and long pants are appropriate. Colored clothing is perfectly acceptable and in many cases most practical when showing your lamb.

Shoes should be sturdy and provide protection for the feet. Thongs, sandals, and bare feet are not appropriate.

Your courtesy in the ring speaks loudly for your attitude. Be considerate of others. You should respond readily to the requests from the judge or ringmaster. Do not jerk, strike, or abuse your animals or use inappropriate language.

You will do much to impress the judge and those watching you in the ring if you keep a cool, clam attitude and move quietly and with confidence. You do not need to be

too serious; you should relax and smile.

Be a modest winner or a gracious loser. Be quick to compliment the others in the ring. Do not criticize or complain when you do not win. Remember, losers often learn more than the winners in the show ring.

When the class is called, take your sheep promptly to the show ring. Be on time. The ringmaster will direct you to your proper place in the ring. In lining up, allow enough room so that you can work freely without bumping the sheep on your left.

Points considered by the judge in a showmanship contest are:

- o Condition and fleshing of the sheep.
- o Feet properly trimmed.
- o Clean hoofs and ears.
- o Whether your sheep has been washed, and if this has been done 2 to 4 weeks before the show (according to judge's opinion).

Showing your lamb

Lead your sheep into the show ring with your left hand under its jaw and your right hand on the dock. "Set him up" in line with the other lambs in the class.

The easiest way to "set the lamb up" is to place the front feet squarely first by lifting its head until the front feet are off the ground and then lowering it gently. Or lift it with one hand under its jaw and the other under its chest as you stand or kneel in front. After the front feet are placed properly, move one rear foot at a time forward or backward as necessary to place them squarely "at the corners" of the lamb. Do this by grasping the rear leg firmly above the hock. If the leg is grasped below the hock the lamb is likely to kick, become excited, and move the front feet out of correct position. You may set the rear right leg by reaching over the lamb or under the lamb.

In the rear view, the position of the lamb should indicate thickness. The legs should be set as wide apart as they will stand naturally-but too wide because a spraddle-legged lamb will appear shallow or "cut up" in the twist and light in the leg. If a lamb tends to stand with its hocks too close together and the rear feet wide and pointing outward, this fault can be covered by spreading the hocks slightly after its rear feet are in place.

In showing your sheep you may stand, squat, or kneel, but always be in position to control your sheep if it should jump. Squatting is generally preferred.

As you squat in front and slightly to the left side of your lamb, check the position of its feet, hocks, and back occasionally and correct the stand as necessary. Keep one eye on your lamb and the other eye on the judge. What

this really means is that you get your lamb set up, watch the judge continually, and also continue to check your lamb. If your lamb is well trained, it will usually stay in correct position until you move it. If you are well trained, you can usually feel it change position; then you glance to see what it did and correct it.

You must watch the judge to see where he is looking so you can react accordingly. Experienced show people are able to anticipate what the judge will do next. Promptly, smoothly, and without nervousness, they shift their position to keep from blocking the judges view of their lamb. They respond immediately to the judge's signal to turn their lamb for a side view, a front view, or back again to a rear view. The routine followed varies in different shows, with different judges. Some judges first view the sheep from the rear, then ask for a side view of the sheep standing head-to-dock, followed by a front view, and then back to a rear view for handling. Other judges walk around in front of the line up to view the width and depth of each lamb's front. If the judge comes from you left as you face your lamb, move slightly to your right to give the judge a good view of your lamb's front. At the moment the judge starts to leave the view-point in front of your lamb, quickly shift to the front of your lamb, changing hands under the jaws as you shift.



This encourages the judge to take a second look at your lamb from the side. If the judge walks around from your right to the front of the line up, you and the others showing should shift to the front immediately. Then each person should step back as the judge passes on to the next lamb. When you shift to the front of the lamb, do not go to the right side.

Practice these movements at home with someone acting as judge. Also, have your assistant show your lamb while you act as judge--you will see why the showing procedures are important.

Sheep show best on level ground or with the front feet a little higher than the hind feet.

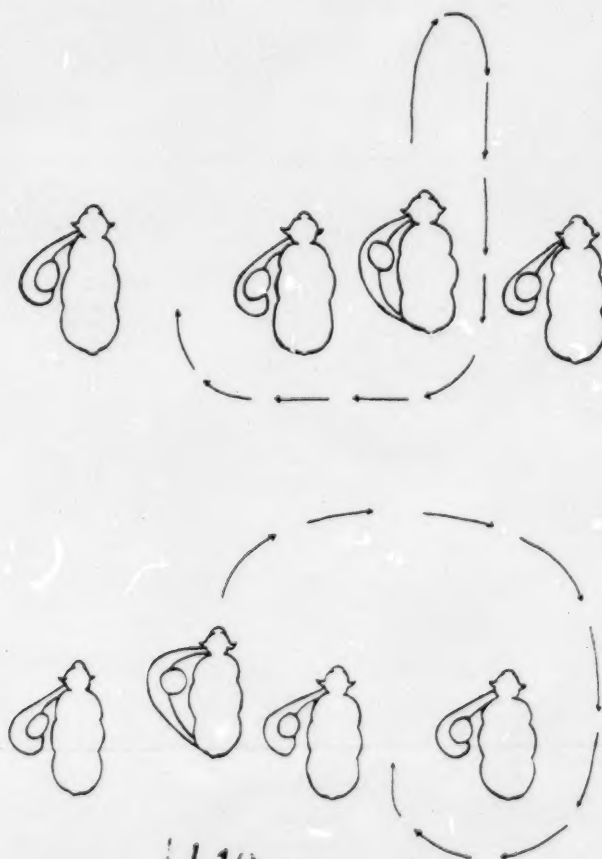
When the sheep judge handles the animals in the show ring you want your lamb to hold its back up straight and strong. It will do this if you make it brace. In bracing, the lamb pushes forward and tenses up the back muscles.

If you are small you may find it helpful to brace your knee against the animal's chest. Never hold or grab a sheep by the fleece--always use a lefthand grip under the chin for holding. Keep your sheep between you and the judge. Never step over your sheep. Show from the left side or front of your animal.

When you are asked to move your sheep to another place in the line you may: lead forward, turn and come back through the spot vacated, turn again and lead into the position designated by the judge (top); or lead around the closest end of the line and into the place designated (bottom).

You may turn left or right but smoothly with full control. If the sheep gets a few steps ahead of its place in line, you may place your hand or knee against its chest to back the sheep into position. Another method of moving your animal back into line is to move forward, make a circle, go back through the line, make another circle and come into line.

Keep your right hand off your animal except when you need to move or control it.



After the judging

Once the class has been judged, take the lamb back to its pen and let it rest. Check your equipment to be sure you still have all of it. Equipment is often misplaced during the last-minute rush to get a lamb ready for the show ring.

Have your lambs well groomed at all times during the remainder of the show. Also, keep your pen and the area around it neat and clean. You owe it to the show management to present your exhibit to the public in the best manner possible.